

UNITED STATES ATOMIC ENERGY COMMISSION

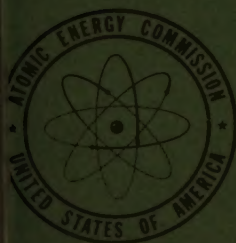
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NEW NUCLEAR DATA

1. Radioactivity, Levels, Abundances, Moments
2. Neutron Cross Sections
3. Ground State Q's
4. Mass Differences and Ratios

INTRODUCTION

The nuclear data presented here have been compiled by the Nuclear Data Group which is sponsored by the National Research Council and supported by the Atomic Energy Commission and the National Bureau of Standards.

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This issue of Nuclear Science Abstracts contains the semi-annual cumulated list of new nuclear data. Issue 18B will contain the next quarterly list and issue 24B the annual cumulation of all data in the 1954 lists.

As the current literature is surveyed, the new nuclear results are first printed on 3" x 5" cards which are collected into sets of 100 to 150 cards each month. Individuals, laboratories, or libraries may subscribe to the card sets directly by applying to the Nuclear Data Group, National Research Council, 2101 Constitution Avenue, N. W., Washington 25, D. C. The price, based on actual mechanical costs is currently \$20 per year domestic and \$30 per year foreign (air mail postage included for foreign but not for domestic subscriptions).

CONVENTIONS

All energies are given in Mev and all cross sections in barns unless otherwise stated in the tabular material.

Numerals in italics following a measured value are the error (as reported by the authors) in the last figures of the values. In cases where confusion seems possible, the conventional \pm is used.

Magnetic moments are reported as before without diamagnetic correction but are now based on $\mu(H) = 2.79267$ and the substandards listed by H. Walchli, ORNL-1469.

In writing reactions in Table 1, Radioactivity, Levels, Abundances, Moments, superscripts to denote the A value of the target nucleus have been used only when the target material is monoisotopic or has been isotopically enriched. " $B^{10}(d,p)$," for example, means that the d,p reaction was observed in a sample enriched in B^{10} while " $B(d,p)$ " means it was observed in natural B. This policy was followed previously for "heavy" but not for "light" nuclei. It was not practical to adhere to it in Table 3, Ground State Q's. In this table enrichment is denoted by underlining the A superscript.

Even when enriched material is not used, the nucleus under which the information is listed is often fairly certain because of some large natural abundance or cross section, or because of the particular activity produced or energy released. In such cases the nucleus in question is put down

without following "?." When there is no indication as to the isotope involved, information is listed under the element in question.

When a method of production of a radioactive nucleus has been given, the lowest bombarding energy used by the experimenter is indicated; e.g. Ag(20-Mev p). If this energy has actually been determined to be the threshold, it is underlined, e.g. Sn(14-Mev p).

The large black dots on the decay schemes are used to indicate experimentally established coincidences. α , β , or γ -rays entering a level and dotted at their arrowheads have been shown to be in coincidence with gamma-rays leaving the same level and dotted at their origins. In case of a simple cascade the dots of the incoming and outgoing rays are superimposed.

Electron capture, ϵ , is shown on decay schemes by long and short dashes. Dashes of equal length are used for doubtful radiations or levels.

For the light nuclei, energy levels in the compound nucleus are tabulated rather than the resonant energy of the bombarding particle. The binding energy of the bombarding particle in the compound nucleus is taken from the table of F. Ajzenberg, T. Lauritsen, *Rev. Mod. Phys.* **24**, 321(1952) for Z 10, and from P. M. Endt, J. C. Kluyver, *Rev. Mod. Phys.* **26**, 95(1954) for Z from 11 to 20.

ABBREVIATIONS

a	absorption measurement	l	angular momentum of particle absorbed into nucleus
a $\beta\gamma$	absorption of β 's in coincidence with γ 's	M	molecular or atomic beam resonance method
ace ⁻	absorption of conversion electrons	M1,M2, ...	magnetic dipole, magnetic quadrupole ...
a coin	measurement by placing absorbers between counters in coincidence	mb	millibarns
α	total γ -ray conversion coefficient, N_{α}/N_{γ}	Mic	microwave method
$\alpha_K, \alpha_L, \dots$	γ -ray conversion coefficient for electrons ejected from the K,L, ... shell	mir	measurement by total reflection of neutron beam from mirror surface
$\alpha_0, \alpha_1, \dots$	α to g.s., first excited state, ... of residual nucleus	ms	mass spectrometer
b	coefficient in angular correlation function, $1 + b \cos^2 \theta$	μ	(1) magnetic moment in units of nuclear magnetons, (2) micron, 10^{-4} cm
B	band spectra method	μ s	microseconds
B _{eyn}	measurement by detection of photoneutrons from Be	osc	pile oscillator method
B _n , B _p	Binding energy of a neutron, proton to a nucleus	p	(1) proton, (2) predecessor of
$\beta\gamma(\theta)$	angular correlation of β 's and γ 's in coincidence	p res	proton resonance. Magnetic field standardized by means of proton resonance frequency
Calc	calculated from experimental work reported elsewhere	para	paramagnetic resonance method
cc	cloud chamber	parentheses	parentheses are put around values which are given for identification purposes
CcW	Cockcroft Walton accelerator	pc	proportional counter
ce ⁻	conversion electrons	pe ⁻	photoelectrons
chem	chemical separation of product following reaction	ppl	photoplates or emulsions
Cpt	Compton electrons	primes	primes indicate inelastically scattered particles
d	(1) deuteron, (2) descendant of, (3) days, when used as superscript	q	electric quadrupole moment in units of barns
d,p(θ)	angular distribution of protons with respect to deuteron beam	quad res	quadrupole resonance method
Dyn,Dyp	measurement by detection of photoneutrons or photoprotons from deuterium	Q	reaction energy in Mev
\bar{E}	average energy	■	(1) spectrometer method, (2) seconds, when used as superscript
E ₀	resonance energy	s pr	pair spectrometer
E β , E γ , ...	energy of β ray, energy of γ ray, ...	S	atomic spectra measurement
E _{dis}	disintegration energy	scin	scintillation counter
EA	electrostatic analyzer	2 cryst scin s	2-crystal scintillation spectrometer
E1,E2, ...	electric dipole, electric quadrupole, ...	sl	lens spectrometer
ϵ_A	Auger electron	sl ce ⁻	conversion electrons measured in lens spectrometer
el	elastic scattering	st	strong
ϵ	electron capture	s π	180° spectrometer
ϵ_K, ϵ_L	electron capture from K, L shell	s $\pi\sqrt{2}$	double focusing spectrometer
f	fission, in abbreviations for methods of production or detection	σ	cross section in barns
F-K	Fermi-Kurie β energy distribution plot	σ_0	cross section at resonance energy, E ₀
$\gamma(\theta, T)$	numbers of γ 's as function of angle and temperature	σ_a	absorption cross section
$\gamma\gamma, \beta\gamma, \alpha\gamma, n\gamma$	$\gamma\gamma, \beta\gamma, \alpha\gamma$, or $n\gamma$ coincidences. (0.123 γ) (0.246 γ , 0.325 γ) means 0.123 γ in coincidence with 0.246 γ and 0.325 γ	σ_{el}	elastic scattering cross section
Γ	resonance half-width (the whole width at half-maximum)	σ_{in}	inelastic scattering cross section
G-M	Geiger-Müller counter	σ_s	scattering cross section
g.s.	ground state	t	(1) triton, H ³ , (2) total cross section when used under σ in cross section list
I	(1) nuclear induction magnetic resonance method; (2) spin in units $h/2\pi$. + or - signs after spin values denote even or odd parity of state in question	T	(1) isotopic spin; (2) temperature
ic	ionization chamber	τ	half life in units indicated
IT	isomeric transition	τ_1, τ_2	half life of upper, lower state
J	quantum state of compound nucleus in a nuclear reaction. "I" is used to denote the spin of the target nucleus, final nucleus	$\tau_{\beta\beta}, \tau_{ee}$	half life for double β , double e decay
K/L	α_K/α_L	th	thermal
		VdG	Van de Graaff accelerator
		w, vw	weak, very weak
		%	% of disintegrations
		†	relative numbers. When used in connection with γ rays, relative numbers of photons, not photons plus conversion electrons, are meant
		+,-	even, odd parity when used in connection with level properties

Standard journal abbreviations are used.

1. RADIOACTIVITY, LEVELS, ABUNDANCES, MOMENTS

n_2 0 2 ?	$56^{Ni}166$ not found by (n^2, p) when Cu exposed to possible n^2 from Bi (23-Mev p, n^2) B.L.Cohen, T.M.Handley, Phys. Rev. 92, 101, (1953).	${}^{Li}_3$ 5 2	$He^3(He^3, p)$ $E_{He^3} = 0.1$ to 0.8 g.s. p group observed at 90° with $E_p \sim 8.5$ No group to first excited level scin W.M.Good, W.E.Kunz, C.D.Moak, Phys. Rev. 94, 87 (1954).
H_1 1 1 stable	Capture γ $H(n, \gamma)$ $E_n = \text{th}$ scin 2.23 No other γ ($E_\gamma = 0.02$ to 3) (<5%) B. Hammermesh, R.J.Culp, Phys. Rev. 92, 211 (1953).		Levels $He(p, p)$ $E_p = 5.78$ $p, \alpha(\theta)$ phase shift analysis shows large splitting of $p_{3/2}, p_{1/2}$ levels ($\Delta E \sim 6\text{-Mev}$) in agreement with Dodder and Gammel, Phys. Rev. 88, 520 (1952).
M_1 1 2 12.47	β^- 0.0176 u Neutrino mass (kev): <0.500 (Dirac) <0.250 (Majorana), <0.150 (Fermi) D.R.Hamilton, W.P.Alford, L.Gross, Phys. Rev. 92, 1921 (1953).		W.E.Kruger, W.Jentschke, P.G.Kruger, Phys.Rev. 93, 837 (1954).
${}^{He}_2$ 2 2 stable	σ graph $H^2(d, p)$ $E_d = 0.013$ to 0.113 pc σ graph $H^2(d, n)$ $E_d = 0.013$ to 0.113 W.R.Arnold, J.A.Phillips, G.A.Sawyer, E.J.Stovall, Jr., J.L.Tuck, Phys. Rev. 93, 483 (1954); 88, 159A (1953).		Capture γ $He^3(d, \gamma)$ $E_d = 0.46$ 16.6 2 scin $\sigma_{\text{max}} \sim 0.05$ mb for $E_d = 0.46$ M.M.Hintz, J.M.Bialr, D.M.Van Patter, Phys. Rev. 93, 910, 924A (1954).
${}^{He}_2$ 2 3 $\sim 10^{-21}$	Levels $H^3(He^3, p)$ $E_{He^3} = 0.30$ g.s. p group observed at $E_p = 9.33$ scin No group to first excited level observed C.D.Moak, Phys. Rev. 92, 383 (1953); 91, 462A (1953).		Level $He^3(d, \alpha)$ $E_d = 0.38$ to 0.58 (16.8) $J = 3/2^+$ $\sigma_{\text{max}} = 0.04$ for $E_d = 0.43$ G.Freier, H.Holmgren, Phys. Rev. 93, 825 (1954).
	Levels $Li^6(n, d)$ $E_n = 14$ dpl g.s. $I_p = 1$ $\Gamma = 0.8$ n, d(θ) (~ 2.6) $I_p = 1?$ "Deuterons with $E_d = 1.7$ to 3.1 below g.s. group. No deuteron peak ascribable to 2.6 level seen. $Li^7(n, t)$ $E_n = 14$ dpl g.s. n, t(θ) (~ 2.6) observed? G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954).	${}^{Li}_3$ 3 3 stable	$ q > 0$ Li^6Cl M $q(Li^6)/q(Li^7)$ is positive P. Kusch, Phys. Rev. 92, 268 (1953).
	Level $H^3(d, n)$ $E_d = 0.007$ to 0.12 16.64 pc $\sigma_{\text{max}} = 4.95$ at $E_d = 0.107$ W.R.Arnold, J.A.Phillips, G.A.Sawyer, E.J.Stovall, Jr., J.L.Tuck, Phys. Rev. 93, 483 (1954); 88, 159A (1953).		$ q(Li^6)/q(Li^7) = 0.019$ $LiAl(SiO_3)_2$ quad res H.G.Cranna, Can. J. Phys. 31, 1185 (1953).
${}^{He}_2$ 2 5	$Li^7(n, p)$ $E_n = 14$ Reaction not observed, $\sigma \leq 5$ mb for $-1 > Q > -7$ G.M.Frye, Jr., Phys. Rev. 93, 1086 (1954).		Level $He(d, d)$ $E_d = 1.0$ to 2.0 2.187 $J = 3^+$ $\Gamma = 0.035$ σ and d, d(θ) No level between 2.2 and 3.2 T.Lauritsen, T.Huus, Phys. Rev. 92, 1501 (1953).
			Levels $He(d, d)$ $E_d = 0.3$ to 4.6 (2.187) parity $\neq \Gamma \sim 0.035$ σ 3.58 level not observed A.Galonsky, R.Douglas, W.Haeberli, M.McEllistrom, H.T.Richards, Phys. Rev. 93, 928A (1954).

- Li⁶**
3 3
stable
- He(d,γ)** $E_d = 1.06$ scin
No 2.19 capture γ ($\sigma < 0.1$ mb)
R.M. Sinclair, Phys. Rev. 93, 1082 (1954).
- Level** **Be⁹(p,αγ)** $E_p = 2.72$
γ 3.57 sl Cpt, pe⁻
M1 from internal e⁺ spectrum
Doppler correction (26 kev) not subtracted
R.J. Mackin, Jr., Phys. Rev. 94, 648 (1954).
- Li⁷**
3 4
stable
- Levels** **B(n,α)** $E_n = \text{th}$ 1c
6.52† g.s.
93.46† (0.478)
†Relative cross sections
J.A. DeJuran, H. Rosenwasser, Phys. Rev. 93, 831 (1954); 92, 544A (1953).
- Levels** **Li⁶(d,D)** $E_d = 8$
g.s. $I_n = 1$ d,p(θ)
(0.478) $I_n = 1$
J.R. Holt, T.N. Marsham, Proc. Phys. Soc. 66A, 1032 (1953).
- γ** **Li(α,α'γ)** $E_\alpha = 3.0$ scin
0.478
G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).
- Level** **Be⁹(d,αγ)**
(0.478) $I = 1/2$ α,γ(θ)
L. Cohen, S.S. Hanna, C.M. Class, Phys. Rev. 94, 419 (1954).
- Levels** **Li(γ,D)** scin
15.0
15.4
From activation curve for 0.83⁺He⁶
S.L. Tucker, C.E. Gregg, Phys. Rev. 93, 362A (1954).
- q negative ?
Calculation takes into account quadrupole moment induced in s electrons by nuclear q
R.M. Sternheimer, H.M. Foley, Phys. Rev. 92, 1460 (1953); R.A. Logan, R.E. Coté, P. Kusch, Phys. Rev. 86, 280 (1952).
- Li⁸**
3 5
8.9⁺
- Level** **Li⁷(d,D)** $E_d = 8$
8.3† g.s. $I_n = 1$ d,p(θ)
†mb/sterad at 0°
J.R. Holt, T.N. Marsham, Proc. Phys. Soc. 66A, 1032 (1953).
- Li⁹**
3 6
0.17⁺
- γ 0.168⁺ C(≤270-Mev γ)
D. Reagan, Phys. Rev. 92, 651 (1953).
- Be⁸**
4 4
~10⁻¹⁶s
- Level** **Be⁹(d,t)** $E_d = 1.16$
g.s. graph of d,t(θ) DPl
M.K. Duric, B.S. Marsicanin, Bull. Inst. Nuclear Sci., Boris Kidrich 3, 139 (1953).
- Levels** **B(p,α)** $E_p = 1.98, 2.61$
g.s.
2.9
No other levels found below 7 Mev (<10% g.s.)
R. Mein, D.R. Inglis, Phys. Rev. 92, 1326 (1953).
- Level** 0.9⁺Li⁸, 0.7⁺B⁸ decay
2.9 $I = 2^+$ $\Gamma = 1.2$ DPl
*Or $I = 4$ if whole α spectrum (0 to 6-Mev) is used to fit single resonance theory
F.C. Gilbert, Phys. Rev. 93, 499 (1954).
- Levels** **B(d,α)** $E_d = 1.0$ DPl
2.9
4.9
7.2
Observed at 4 angles, ~15,000 α's at each angle
P. Cürer, J.J. Jung, R. Bilmes, Compt. rend. 238, 1405 (1954).
- Levels** **Li⁷(p,γ)** $E_p = 0.44$
2.0%* (4.09) α ranges
1.9%* 5.81
0.5%* 7.51
*α pairs per γ from 17.63 level αγ
E.K. Inall, A.J.F. Boyle, Phil. Mag. 44, 1081 (1953).
- Li(d,nγ)** $E_d = 0.65$
4.9 level not found
γ's with $E_\gamma = 4$ to 8 not observed scin
~4.9γ previously reported from this reaction now attributed to C¹²
R.M. Sinclair, Phys. Rev. 93, 1082 (1954).
- B(γ,d) C(γ,α)** $E_\gamma = 17.6$
4.9 level not found DPl
No three pronged stars with 4.9-Mev total energy deficit (from possible intermediate Be⁸ 4.9γ emitting state)
E.W. Titterton, Phys. Rev. 94, 206 (1954).
- Levels** **He(α,α)** $E_\alpha = 12.9$ to 21.6
7.55 $J = 0$ $\Gamma = 1.2$
10.8 $J = 4$ $\Gamma = 1.2$ α,α(θ)
F.E. Steigert, M.B. Sampson, Phys. Rev. 92, 660 (1953).

Be^8 4 4 $\sim 10^{-16}$ s	Levels	$\text{Li}(d,n)$	$E_d = 0.4$ to 4.7
		16.70	$\Gamma = 0.185$
		16.99	$\Gamma = 0.350$
		17.63	narrow
		18.14	wide
	"Threshold" n's detected		

T.W.Bonner, C.F.Cook, Phys. Rev. 94, 807A (1954).

Level	$\text{Li}(D,D')$	$E_p = 1.05$ to 1.24
	18.13	s

$D, D'(\theta, E_p)$ shows interference between levels of opposite parity

F.Mozer, W.A.Fowler, C.C.Lauritsen, Phys. Rev. 93, 829 (1954).

Level	$\text{Li}(D,\gamma)$	$E_p = 0.88$ to 1.24
	18.13	scin

$D, > 5\text{-Mev } \gamma(\theta, E_p)$ shows interference between levels of opposite parity.

A.A.Kraus, Jr., Phys. Rev. 93, 1308 (1954).

$D, \alpha(\theta)$	$\text{Li}(D,\alpha)$	$E_p = 0.61, 0.71, 0.80$
Coefficients of angular distribution given		

D.K.Cartwright, L.L.Green, J.C.Willmott, Phil. Mag. 44, 1307 (1953).

Be^9 4 5 stable	q	~ 0.02	Mic
W.D.Knight, Phys. Rev. 92, 539A (1953).			

Be^{10} 4 6 2.5×10^{10} y	Level	$\text{Be}^9(d,D)$	$E_d = 1.16$
		g.s.	graph of $d,D(\theta)$ dpl

M.K.Jurić, B.S.Marsicanin, Bull. Inst. Nuclear Sci., Boris Kidrich 3, 139 (1953).

Level	$\text{Be}^9(d,D)$	$E_d = 8$
	g.s.	$I_n = 1$ $d,D(\theta)$

J.R.Molt, T.W.Marsham, Proc. Phys. Soc. 66A, 1032 (1953).

Level	$\text{Be}^9(d,D\gamma)$	$E_d = 0.84$
	3.37	$I \geq 2$ $D,\gamma(\theta)$

L.Cohen, S.S.Hanna, C.M.Class, Phys. Rev. 94, 419 (1954).

Levels	$\text{Be}(d,D)$	$E_d = 5.4$ to 7.6
	3.37	6.26 s
	5.98	7.37
	$\sim 6.18^*$	7.52

C.K.Bockelman, J.J.Jung, Phys. Rev. 94, 748A (1954); * verbal report.

B^8 5 3 0.7 ^s	B^8 and Li^8 decay to same levels of Be^8 $\sim 15\%$ of decays go to Be^8 levels above 2.9 a range distribution in ppl $\text{Be}(375\text{-Mev } \alpha)$
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F.C.Gilbert, Phys. Rev. 93, 499 (1954).

B^9 5 4	Levels	$\text{Be}^9(D,n)$
		~ 1.4 ? wide
		2.36 narrow
	"Threshold" n's detected	

J.B.Marion, C.F.Cook, T.W.Bonner, Phys. Rev. 94, 807A (1954).

B^{10} 5 5 stable	Level	$\text{Be}^9(d,n)$	recoil
	γ	(0.72)	$\tau = 7 \pm 2 \times 10^{-10}$ s

J.Thirlion, V.L.Telegd, Phys. Rev. 92, 1253 (1953).

Levels	$\text{Be}^9(d,n)$	$E_d = 0.96$	dpl
	$\frac{I_p}{\gamma}$		
	g.s.	1	$d,n(\theta)$
weak	0.72	1	
	1.74	1	
	2.15	1	
	3.58	1	

Distributions show combination of stripping and compound nucleus formation

J.S.Pruitt, C.D.Swartz, S.S.Hanna, Phys. Rev. 92, 1456 (1953); 91, 463A (1953).

Levels	$\text{B}^{10}(D,D')$	$E_p \sim 7$	397
	0.717	5	
	1.739	5	
	2.152	5	
	3.583	5	
	4.771	5	

$\text{B}^{10}(d,d')$
1.74 level not observed

C.K.Bockelman, C.P.Browne, W.W.Buechner, A.Sperduto, Phys. Rev. 92, 665 (1953); 90, 340A (1953)

Levels	$\text{Be}^9(d,n)$	$E_d = 0.4$ to 4.7
	4.78	6.04
	5.11	6.16
	5.17	6.61
	5.93	

"Threshold" n's detected

T.W.Bonner, C.F.Cook, Phys. Rev. 94, 807A (1954).

Levels	$\text{Be}^9(D,\gamma)$	$E_p = 0.90$ to 1.14
	(7.48) $J = 2^-$	$D,\gamma(\theta)$
	(7.56) $J = 0^+$	$D,\gamma(\theta)$

E.B.Paul, H.E.Gove, Proc. Roy. Soc. Canada, 47, 145A (1953).

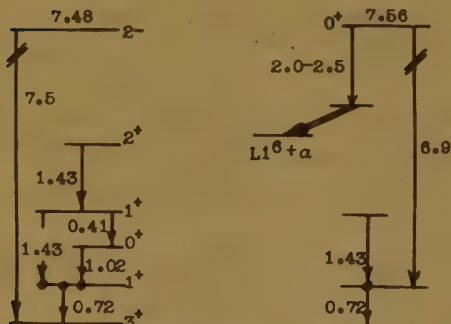
B^{10}
5 5
stable

Capture γ 's	$Be^9(d,\gamma)$	scin
7.48 level $E_p = 0.993$ $\Gamma = 0.088$		
0.26†	0.41	~0.3† 1.43
2.3 †	0.72	18.9† 7.5
0.6 †	1.02	

7.56 level $E_p = 1.085$ $\Gamma \sim 0.004$

$\leq 0.008†$	(0.41)	~0.06†	1.43
1.1 †	0.72	~0.15†	2.0-2.5
$\leq 0.04 †$	(1.02)	1.0 †	6.9

†Thick target γ yield per 10^9 protons



Stable B^{10}

W.F. Hornyak, T. Coor, Phys. Rev. 92, 675 (1953)
91, 463A (1953).

Level $Be^9(p,\alpha\gamma)$ $E_p = 2.56$
(8.89) $J = 2^+$, $T = 1$

Spin assignments deduced from σ

R.J. Macklin, Jr., Phys. Rev. 94, 648 (1954).

B^{11}
5 6
stable

q +0.0355 z M
G. Wessel, Phys. Rev. 92, 1581 (1953).

Level $B^{10}(d,D)$ $E_d = 1.43$ pc
g.s. $l_n = 1$ $d,D(\theta)$

W.M. Burke, J.R. Resser, G.C. Phillips, Phys. Rev. 93, 188 (1954).

Levels $B^{10}(d,D)$ $E_d = 3.03$ ppl
g.s. $l_n = 1$ $d,D(\theta)$

$d,D(\theta)$ for g.s. and first 3 levels shows large compound nucleus contribution

W.W. Pratt, Phys. Rev. 93, 816 (1954).

Level $B(d,D)$ $E_d = 8$
g.s. $l_n = 1$ $d,D(\theta)$

J.R. Holt, T.M. Marsham, Proc. Phys. Soc. 66A, 1032 (1953).

B^{11}
5 6
stable

Levels	$B^{10}(d,D)$	$E_d = 8.06$ ST
9†	7.99 1	$\Gamma < 0.010$ for
9†	8.57 1	first 5 levels
56†	8.93 1	
100†	9.19 1	
	9.28 1	

~60† 10.32 2 $\Gamma = 0.054$

† Rel. numbers of protons at 90°

W.M. Elkind, Phys. Rev. 92, 127 (1953); 91, 463A (1953)

Levels	$Be^9(d,n)$	$Be^9(d,p)$	$E_d = 0.96$
	~16.7	$J = 3/2^+$	$d,n(\theta)$
	~16.7	$J = 5/2^-$	$d,p(\theta)$

Strong $\cos \theta$ terms superimposed on stripping patterns consistent with above spins

J.S. Pruitt, C.D. Swartz, S.S. Hanna, Phys. Rev. 92, 1456 (1953); 91, 463A (1953).

B^{12}
5 7
0.03^a

Levels	$B^{11}(d,D)$	$E_d = 8.06$ ST
100†	g.s.	$\Gamma < 0.010$ for
78†	0.95 1	all levels
285†	1.67 1	
69†	2.62 1	
4†	2.72 1	
186†	3.38 1	

† Rel. numbers of protons at 90°

W.M. Elkind, Phys. Rev. 92, 127 (1953); 91, 463A (1953)

Levels	$B(d,D)$	$E_d = 8$	l_n	$d,D(\theta)$
7††	g.s.	1		
11†	(0.95)	1		
54†	(1.67)	0		
25†	(3.38)	1		
1††	(3.76)	1?		
29†	(4.53)	2		

†mb/sterad at 0° ††mb/sterad at $15^\circ, 35^\circ$ resp.

J.R. Holt, T.M. Marsham, Proc. Phys. Soc. 66A 1032 (1953).

B^{13}
5 8
1

τ $< 5 \times 10^{-12}$ or $> 0.5^h$
No activity attributable to this nucleus found when various low and middle Z targets irradiated by 340-Mev p, 190-Mev d

E.L. Hubbard, L. Ruby, W.F. Stubbins, Phys. Rev. 92, 1494 (1953).

B^{11}
6 5
20.4^m

$B^{10}(d,n)$ $E_d = 0.7$ to 1.4
 $d,n(\theta)$ shows $l_p = 1$ but neutron energies not determined long counter

W.M. Burke, J.R. Resser, G.C. Phillips, Phys. Rev. 93, 188 (1954).

C^{11}
6 5
20.4"

Resonances $B^{10}(D,\gamma)$ $E_p = 0.5$ to 1.7
0.78 broad
0.95?
1.33?

R.W.Krone, L.W.Seagondollar, Phys. Rev. 92, 935 (1953).

C^{12}
6 6
stable

Levels $Be^9(\alpha, n\gamma)$ $E_\alpha = 5.3$
94† g.s. scin
6† 4.4

†From measured rates and efficiencies
assuming above are only levels involved

D.E.Diller, M.F.Crouch, Phys. Rev. 93, 362A (1954).

Level $N(d,\alpha)$ $E_d = 0.62$
100† (4.43)
6† 7.68 3 $\Gamma < 0.025$ sm/2
No other level below 9.2 Mev (<1†)

D.H.F.Dunbar, R.E.Pixley, W.A.Wenzel, W.Whaling, Phys. Rev. 92, 649, 1095A (1953).

γ 's $Be^9(\alpha, n\gamma)$ $E_\alpha = 5.3$
(4.43) $E2, M1$ $e^+e^-(\theta)$ cc
~7 $0 \rightarrow 0$ (7 pairs observed)

G.Harries, Proc. Phys. Soc. 67A, 153 (1954).

$B^{11}(d,n)$ $E_d = 0.7$ to 1.6
 $d,n(\theta)$ shows $l_p = 1$ but neutron energies
not determined long counter

$B^{10}(d,n)$ $E_d = 0.2$ to 2.0
No resonances observed long counter

Resonances $B^{10}(d,D); B^{10}(d,p\gamma)$
~1.0 ? pc
~1.5 ?

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

$C(\gamma, \alpha)Be^8$ $E_\gamma = 17.6$ ppl
 $C(\gamma, 3\alpha)$

α energy distribution from 109 stars suggests
both reactions take place

R.Chastel, J. Phys. Radium 15, 240 (1954).

Levels $B^{10}(\alpha, D)$ $E_\alpha = 1$ to 2 s
 J $\alpha, D(\theta)$
g.s. $1/2^-$
3.13 $1/2^+$
3.72 $3/2^-$
3.86 $5/2^+$

No 0.7 level (<7% of g.s. protons)
0.21 γ observed, interpreted as 30% branch
from 3.9 to 3.7 level
Yield proton groups given for 7 α energies

E.S.Shire, J.R.Wormald, G.Lindsay-Jones, A.Lundén, A.G.Stanley, Phil. Mag. 44, 1197 (1953).

C^{13}
6 7
stable

$B(\alpha, p)$ $E_\alpha = 5.3$
No 0.7 level apy
J.Thirlion, Ann. Phys. 8, 489 (1953).

Levels $B^{10}(\alpha, D)$ $E_\alpha = 4.8, 5.8$ s
3.09
3.68
3.8

No 0.70 level (p yield < 1% of g.s. group)*
No 4.6 level (p yield < 1% of 3.85 level group)*

W.J.Fader, A.Sperduto, Phys. Rev. 94, 748A (1954); * verbal report.

Levels $B^{10}(\alpha, p\gamma)$
(3.68) $I = 3/2^-$ $p\gamma(\theta)$
(3.89) $I = 5/2^+$
 $E_\alpha = 1.31, 1.51, 1.64, 1.83$
*0.21 γ (from 3.89 to 3.68 level) is $E1$ $p\gamma(\theta)$
A.G.Stanley, Phil. Mag. 45, 430 (1954).

γ 's $C(d, p\gamma)$ $E_d = 2.4$
0.168 sl pe-
45† (3.08) sl Cpt
5† 3.67
4† 3.83

R.J.Mackin, Jr., Phys. Rev. 92, 929A (1953).

Level $C(n, n)$ $E_n = 2.08$, scin
(6.87) $J = 3/2^+, 5/2^+$ $n, n(\theta)$

R.Ricamo, Nuovo Cim. 10, 1607 (1953).

Levels $Be^9(\alpha, n); Be^9(\alpha, n\gamma)$
11.02 $E_\alpha = 0$ to ~ 2
11.08
12.0

W.E.Bennett, P.A.Roya, B.J.Toppel, Phys. Rev. 93, 924A (1954).

Levels $Be^9(\alpha, n)$ $E_\alpha = 1.0$ to 3.5
11.98 long counter
12.21
12.44
13.01

R.E.Trumble, Jr., Phys. Rev. 94, 748A (1954).

$B^{11}(d,n)$ $E_d = 0.2$ to 2.0
No resonances observed long counter

W.H.Burke, J.R.Risser, G.C.Phillips, Phys. Rev. 93, 188 (1954).

C^{14}
6 8
~3600y

Level $C^{13}(d,D)$ $E_d = 0.28$ to 0.64
g.s. $I_n = 1$ d,D(θ)
Reaction proceeds mainly by stripping

B. Koudijs, F.P.G. Vaickx, P.M. Endt, Physica 19, 1133 (1953).

γ $C^{13}(d,\gamma)$ $E_d = 1.9$
6.12 sl Cpt
6.73

Values without Doppler corrections

No additional γ 's at $E_d = 2.6$

R.J. Mackin, Jr., W.B. Mims, W.R. Mills, Phys. Rev. 93, 950A (1954).

C^{15}
6 9
2.4s

Level $C^{14}(d,D)$
g.s. $I = 5/2$? from σ curve

J.A. Rickard, E.L. Hudspeth, Phys. Rev. 94, 806A (1954).

τ 2.4s $C^{14}(2\text{-Mev } d)$
 γ ~5.3 scin
Several weak γ 's with $E_\gamma > 5.3$

K.R. Spearman, E.L. Hudspeth, I.L. Morgan, Phys. Rev. 94, 806A (1954).

N^{13}
7 6
10.1m

Levels $N(d,D)$ $E_p = 18.7$ scin
g.s. $I_n = 1$ D,d(θ)

d group to N^{13} 2.37 level not found
($< 4\%$, 15% of g.s. group if $I_n = 0, 2$)

K.G. Standing, Phys. Rev. 94, 731 (1954).

Level $C(p,D)$ $E_p = 0.3$ to 0.6
2.370 $\Gamma = 0.032$ D,D(θ)

E.A. Milne, Phys. Rev. 93, 762 (1954).

Levels $C^{12}(D,\gamma)$ $E_p = 1$ to 3 scin
(2.37)

Capture γ to 2.37 level observed as f(E_p)

2.37 level decays mainly to $C^{12} + p$

(3.511) $\Gamma_\gamma(1.14\gamma) = 0.04\text{ev}$

($\Gamma_\gamma(3.51\gamma) = 0.7\text{ev}$)

$\gamma(E,\theta)$ near this resonance explained as due to interference between non-res. capture γ and res. radiation

M.H. Woodbury, A.V. Tollestrup, R.B. Day, Phys. Rev. 93, 1311 (1954).

Levels $C(D,D)$ $E_p = 2$ to 7
~4.2 a
~6.4

$C(D,D'\gamma)$ $E_p = 2$ to 7
6.90 a
7.40

M. Martin, H. Schneider, M. Sempert, Helv. Phys. Acta 26, 995A (1953).

N^{14}
7 7
stable

Levels $O(d,\alpha)$ $E_d = 19$ dpl
2.6† g.s.
<0.1† (2.31)
†Total σ in mb

R.G. Freemantle, W.M. Gibson, D.J. Prowse, J. Rotblat, Phys. Rev. 92, 1268 (1953).

Levels $N(p,D')$ $E_p \sim 7$ 27
2.313 s
3.945 s
4.91 1
5.10 1
 $N(d,d')$
2.31 level not observed

C.K. Sockelman, C.P. Browne, W.W. Buechner, A. Sperduto, Phys. Rev. 92, 665 (1953); 90, 340A (1953).

γ $C^{13}(d,m\gamma)$ $E_d = 1.4, 1.9$ sl Cpt
w 3.91
4.93
5.13
5.73
6.45*

No 5.82y, ($< 14\%$ of 5.73y at $E_d = 1.42$)

No additional γ 's at $E_d = 2.6$

*Not observed at $E_d = 1.4$

Values without Doppler correction

R.J. Mackin, Jr., W.B. Mims, W.R. Mills, Phys. Rev. 93, 950A (1954).

Levels $C^{13}(D,D)$ $E_p = 0.45$ to 1.60
J
(8.06) 1- D,D(θ)
(8.62) 0†
(8.70) 0-
8.90 3-?
8.98 1†?

E.A. Milne, Phys. Rev. 93, 762 (1954); 92, 1085A (1954).

Capture γ 's $C^{13}(D,\gamma)$ scin
8.06 level $E_p = 0.55$ $T = 1 > 88\%$
2.307 <0.7† (5.70)
4.11 100† 8.06

A.B. Clegg, D.H. Wilkinson, Phil. Mag. 44, 1269, (1953).

γ 's $C^{13}(d,m\gamma)$ scin
5.69 level (3.38y) (2.31y)
5.81 level (0.73y) (4.5-5.2y)

Capture γ 's $C^{13}(D,\gamma)$ scin
8.06 level $E_p = 0.55$ $\Gamma = 0.033$
7.3† 1.63 15† 4.0
7.3† 2.32 89† 8.0
8.62 level $E_p = 1.16$ $\Gamma = 0.006$
39† 1.64 59† 4.7
66† 2.33 27† 6.25
20† 3.94 14† 8.6

N^{14}
7 7
stable

8.70 level $E_p = 1.25$ $\Gamma = 0.5$
 $\geq 90^\circ$ 8.7

8.90 level $E_p = 1.47$ $\Gamma = 0.02$
65 $^\circ$ 0.731 100 $^\circ$ 3.09
17 $^\circ$ 2.32 48 $^\circ$ 5.1
17 $^\circ$ 2.8 36 $^\circ$ 5.7

8.98 level $E_p = 1.55$ $\Gamma = 0.007$
 $\geq 85^\circ$ 9.0

9.17 level $E_p = 1.76$ $\Gamma = 0.0021$
10 $^\circ$ 2.73 90 $^\circ$ 9.2
10 $^\circ$ 6.5

9.49 level $E_p = 2.10$ $\Gamma = 0.045$
20 $^\circ$ 2.32 100 $^\circ$ 4.41
20 $^\circ$ 2.78 74 $^\circ$ 5.09

H.N.Woodbury, R.B.Day, A.V.Tollestrup, Phys. Rev. 92, 1199 (1953).

Levels	$B^{10}(\alpha, D)$	$B^{10}(\alpha, d)$
	$\frac{J}{\Gamma}$	$\frac{J}{\Gamma}$
12.42	4 $^-$	0.043
12.50		0.038
12.61		0.050
12.69	3 $^-$	0.014 *
12.78	4 $^+$	0.014 *
12.81	4 $^-$	0.005
12.92	4 $^+$	0.021

No capture γ 's scin

Yield p and α groups given for 7 α energies

*All partial Γ 's also given $E_\alpha = 1$ to 2

E.S.Shire, J.R.Wormald, G.Kindsay-Jones, A.Lundén, A.G.Stanley, Phil. Mag. 44, 1197 (1953).

Levels	$B^{10}(\alpha, D\gamma)$	$E_\alpha = 1.13$ to 1.64
12.42	J = 3 $^-$	$D, \gamma(\theta)$
12.69	J = 4 $^+$	
12.78	J = 4 $^+$	

Distribution of 0.2 and 3.7+3.9 $C^{13}\gamma$'s consistent with above spins

A.G.Stanley, Phil. Mag. 43, 430 (1954).

Level $N(d, p)$ $E_d = 0.4, 0.5, 0.6$
(g.s.) $l_n = 1$ $d, p(\theta)$

Position of minimum agrees with stripping theory but high yield shows compound nucleus formation important

H.W.Jongerius, F.P.G.Valeix, P.M. Endt, Physica 20, 29 (1954).

N^{15}
7 8
stable

Levels	$N(n, p)$	$N(n, \alpha)$
	11.26 12.37 11.91 13.21	
	11.41 12.46 11.99 13.49	
	11.78 12.65 12.10 13.61	
	11.91 12.90 12.17 13.74	
	12.02 13.01 12.39 13.85	
	12.12 12.49 13.95	
	12.63 14.01	
	12.86 14.14	
	12.96	
	RaBe n	1c

G. von Gierke, Z.Naturf. 8a, 567 (1953).

Levels	$B(\alpha, n)$	$E_\alpha = 1.0$ to 3.5
	12.12	long counter
	12.52	13.19
	12.92	13.38

R.E.Trumble, Jr., Phys. Rev. 94, 748A (1954).

Capture γ 's $C^{14}(d, \gamma)$ $E_p = 1$ to 2
 ~ 5 scin
Other γ 's with $E_\gamma \leq 10$ Mev

K.R.Spearman, E.L.Hudspeth, I.L.Morgan, Phys. Rev. 94, 806A (1954).

$O^{18}(d, \alpha)$ $E_p = 0.4$ to 0.7
No γ scin

R.R.Roy, A.Lagasse, M.J.Dacock, Phil. Mag. 44, 1189 (1953).

N^{16}
7 9
7.4 *

τ 7.38 s $O(12\text{-Mev } n)$
H.C.Martin, Phys. Rev. 93, 498 (1954).

Level $C^{14}(d, p)$ $E_d = 0.6$ to 3.0
12.6 $\Gamma \sim 0.40$

J.A.Rickard, E.L.Hudspeth, Phys. Rev. 94, 806A (1954).

O^{18}
8 6
77 *

β^- 100 $^\circ$ 1.83 $N(p, n); \beta\gamma$ scin
31 $^\circ$ (4.14)

J.R.Penning, F.M.Schmidt, Phys. Rev. 94, 779A (1954).

Levels $N(p, n)$ $E_p = 17.3$ Dp1
5.2 }
7.5 } wide or unresolved
9.3 }

No levels 0 to 6.5 (n yield < 25% of g.s. group)

F.A.Jenzenberg, W.Franzen, Phys. Rev. 94, 409 (1954).

⁰¹⁵ 8 7 2.0m	Levels	N(D,D)	E _p = 1.3 to 1.9
		8.78 J = 1/2+	D,D(θ)
		8.95 J = 3/2-	
		9.01	

H.E.Gove, A.J.Ferguson, J.T.Simpie, Phys. Rev. 93, 928A(1954).

⁰¹⁶ 8 8 stable	γ	F ¹⁹ (D,αγ)	E _p = 0.84
		(6.05) 0 → 0	e ⁺ e ⁻ (θ) G-M

S.Devons, G.Golding, G.R.Lindsey, Proc. Phys. Soc. 67A, 134 (1954).

Levels	O(D,D')	E _p = 9.5	ddl
	(6.05)	(6.9)	
	(6.13)	(7.1)	

W.E.Burcham, W.M.Gibson, A.Hossain, J.Rotblat, Phys. Rev. 92,1266(1953).

Levels	F ¹⁹ (D,αγ)	E _p = 0.87
	<u>I</u>	
	(6.13) 3-	
	(6.9) 2 ⁺	
	(7.1) 1-	

γ polarization studied by D(γ,D)

L.W.Fagg, S.S.Hanna, Phys. Rev. 92,372(1953); 88, 1205(1952).

Levels	C(α,α)	E _α = 4 to 6
	~10.3 J = 4+	pc
	11.1 narrow α,α(θ)	
	~11.5 J = 2+ broad	

W.Haeberli, J.W.Bittner, R.D.Moffat, Phys. Rev. 94, 769A (1954).

Levels	N ¹⁵ (D,α)	E _p = 0.23 to 0.96
	12.43 J = 0 ⁺	D,α ₀ (θ)
	13.08 J = 1-	

A.V.Cohen, A.P.French, Phil. Mag. 44, 1259(1953).

⁰¹⁷ 8 9 stable	Levels	O(d,p)	E _d = 19	ddl
		30† 9.9. I _n = 2		d,D(θ)
		23† (0.88) I _n = 0		

†Total σ in mb

R.G.Freemantle, W.M.Gibson, D.J.Frowse, J.Rotblat, Phys. Rev. 92,1268(1953).

Level	O(d,p)	E _d = 1.66 to 2.2	ddl
	(0.88) I _n = 0		d,D(θ)

A.Berthelot, R.Cohen, E.Cotton, H.Faraggi, T.Grjebine, A.Levêque, V.Haggler, M.Roclawski-Conjeaud, D.Szteinszneider, Compt. rend. 238, 1312 (1954).

⁰¹⁷ 8 9 stable	Level	O(d,n)	recoil
		(0.88) τ = 2.5 ± 1.0 × 10 ⁻¹⁰ s	

J.Thirlion, V.L.Telegdi, Phys. Rev. 92,1253(1953).

Level	N(α,D)	E _α = 5.30	ddl
	0.86		

E.Hjalmar, H.Silfka, Arkiv Fysik 6,451(1953).

Level	Ne(n,α)		ic
	0.87		

F.C.Flack, J.B.Warren, Proc. Roy. Soc. Canada, 47, 131A(1953).

Levels	O(n,n)	E _n = 0.39 to 1.4
	4.56 J = 3/2-	n,n(θ)
	5.08 J = 3/2+	0 recoil
	5.39 J = 3/2-	

R.K.Adair, Phys. Rev. 92, 1491 (1953).

Levels	O(n,α)	
	6.55 7.28	
	6.79 7.43	
	6.96 7.63	
	7.11	

Li(d,n) ic

K.Kimura, R.Ishiwari, M.Sakisaka, I.Kumabe, S.Yamashita, K.Miyake, Bull. Inst. Research, Kyoto. Univ. 31,204(1953); Chem. Abstr. 47-10358g(1953).

Levels	O(n,α)	
	6.83 7.85 9.76 11.36	
	6.89 7.987 10.07 11.49	
	6.99 8.23 10.257 11.617	
	7.11 8.62 10.39 11.84	
	7.35 8.84 10.57 12.03	
	7.48 9.09 10.85 12.25	
	7.63 9.34 11.077 12.47	
	7.71 9.577 11.17 12.737	

RaBe n ic

G. von Glerke, Z. Naturf. 8a, 567 (1953).

Levels	C(α,n)	E _α = 0 to 2
	7.158 9	Γ _α ~ 0.003 scin
	7.372 11	

G.A.Jones, D.H.Wilkinson, Proc. Phys. Soc. 66A, 1176 (1953).

Levels	C ¹³ (α,n)	E _α = 1.0 to 3.5
	8.21	long counter
	8.28	
	8.45	
	8.66	

R.E.Tramble, Jr., Phys. Rev. 94, 748A (1954).

^{21}Ne	Levels	$\text{Ne}(n,\alpha)$			
10 11		8.13	9.39	10.81	12.38
stable		8.27	9.48	11.02	12.64?
		8.45	9.68	11.17	12.83
		8.59?	9.86	11.30	12.98
		8.71	10.33	11.49	13.10?
		9.00	10.47	11.60	13.32?
		9.10	10.60?	11.90	13.42
		9.18			

RaBe n 1c

G. v. Gierke, Z.Naturf. 9A, 164 (1954).

Levels	$\text{Ne}(n,\alpha)$		
	9.85	10.85	11.27
	10.08	10.90	11.38
	10.32	11.04	11.44
	10.48	11.12	11.49
	10.72	11.20	11.60

Assuming $B_n(^{20}\text{Ne}) = 6.756$

F.C. Flack, J.B. Warren, Proc. Roy. Soc. Canada 47, 131A (1953).

^{22}Ne		$\text{Ne}(p,p'\gamma)$	$E_p = 1.35$ to 4.4
10 12	NO 0.4 γ		scin
stable			

M.C. Cox, J.J. vanLoef, D.A. Lind, Phys. Rev. 93, 925A (1954).

Levels	$^{19}\text{F}(\alpha,p'\gamma)$		$E_\alpha = 7.6$
	<u>1.28 level</u>		
γ	1.28		p γ scin
	<u>3.3 level</u>		
γ	75† 1.28		p γ scin
	75† 2.1	25† 3.4	
	<u>4.9 level</u>		
γ	50† 1.28	~50† 4.9	p γ scin
	50† 3.6		

NO 1.5 γ (<5†)

B.P. Foster, G.S. Stanford, L.L. Lee, Jr., Phys. Rev. 93, 1069 (1954); 94, 804A (1954).

^{21}Ne	Levels	$\text{Ne}(p,p'1.64\gamma)$	$E_p = 1.35$ to 4.4
11 10		4.33	5.73 scin
23 ^a		4.44	5.84
		4.50	5.85
		5.05	6.11
		5.49	6.26

M.C. Cox, J.J. vanLoef, D.A. Lind, Phys. Rev. 93, 925A (1954).

^{22}Ne	ϵ	$9.9 \pm 0.6\%$	$\beta^+\gamma$
11 11			
2.6 γ			

Theoretical value for allowed transition = 10.2%

R. Sherr, R.W. Miller, Phys. Rev. 93, 1076 (1954); 92, 848A (1953).

^{22}Na	ϵ	$7 \pm 2\%$
11 11		
2.6 γ		

W.F. Hornyak, T. Coor, Phys. Rev. 92, 675 (1953).

 $\beta^+ / 1.28\gamma = 0.89 \pm 0.05$ scin

D. Maeder, R. Müller, V. Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

^{23}Na	$\text{Na}^{23}(\alpha,\alpha'\gamma)$	$E_\alpha = 3.0$
11 12		
stable	0.446 ^a	scin

G.M. Temmer, M.P. Heydenburg, Phys. Rev. 93, 351 (1954); ^apriv. comm.

^{24}Na	Levels	$\text{Na}^{23}(d,p)$	$E_d = 3.0$
11 13			
19.0 ^h			

I_n	
g.s.	2
(0.472)	0 and 2
(0.564)	
(1.341)	

P. Shapiro, Phys. Rev. 93, 290 (1954).

^{24}Mg	γ	$\text{Mg}(n,n'\gamma)$	$E_n = 14$	scin
		1.4		n γ

R.E. Garrett, F.L. Hereford, D.W. Sloope, Phys. Rev. 92, 1507 (1953); 91, 441A (1953).

$\text{Mg}(\alpha,\alpha'\gamma)$	$E_\alpha = 3.0$	scin
NO γ		

G.M. Temmer, M.P. Heydenburg, Phys. Rev. 93, 351 (1954).

^{24}Mg	Resonances	$\text{Na}^{23}(D,\gamma)$	$\Gamma < 50$ ev
12 12		0.3022 6	
stable		0.5945 15	$\Gamma \sim 400$ ev

D.H. Turner, Australian J. Sci. Res. 6, 380, (1953).

Capture γ 's	$\text{Na}^{23}(D,\gamma)$	$E_p = 0.3022$
~25†	0.41 4†	6.2 scin
≤30†	0.63 3†	6.8
~50†	0.80 0†	7.2
~70†	1.38 44†	7.73
20†	2.86 ~1†	8.5
14†	3.43 13†	9.2
18†	3.89 7†	9.9
28†	4.30 13†	10.6
~2†	5.3 4†	11.2
~3†	5.8 23†	11.8

 $\gamma\gamma$ coincidences support decay scheme

D.H. Turner, Australian J. Sci. Res. 6, 380, (1953).

Mg^{24} 12 12 stable	Levels See also Mg^{26}	Ne (α, α) J	$E_p = 2$ to 4 pc Γ_α (kev) $\alpha, \alpha(\theta)$
		11.405 1-	
		11.476 0+	
		11.542 2+	
		11.751 0+	10
		11.883 1-	8
		11.985 2+	
		12.288 3-	
		12.481 1-	7
		12.499 2+	5
		12.531 4+	
		12.601 2+	6

E. Goldberg, W. Haeblerli, A. I. Galonsky,
R. A. Douglas, Phys. Rev. 93, 799 (1954).

Levels	Mg^{23} (D, γ)	$E_p = 0.85$ to 1.70 Γ_γ γ 's
	0+	12.67 0.004
	9+	12.68 0.006
	8+	12.75 0.010
	10+	12.82 0.004
	12+	12.86 0.004
	14+	12.90 0.004
	57+	12.93 0.008 1.6
		12.97 1.4, 11.6
	104+	12.98 0.010 1.6
	12+	13.04 0.004 4.5, 8.5
	12+	13.06 0.004 1.4, 2.8, 9.0
	118+	13.10 0.012 1.6
	353+	13.28 0.033 1.6

J. W. Teeher, L. W. Seagondollar, R. W. Krone, Phys.
Rev. 93, 1035 (1954).

Mg^{26} 12 14 stable	Levels	Ne (α, α) J = 3- 13.388 J = 3- 13.534 J = 3-	$E_p = 2$ to 4 pc $\Gamma_\alpha = 2.5$ kev $\Gamma = 3.2$ kev $\alpha, \alpha(\theta)$
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Assignment based on relative intensities and
isotopic abundances

E. Goldberg, W. Haeblerli, A. I. Galonsky,
R. A. Douglas, Phys. Rev. 93, 799 (1954).

Mg^{27} 12 15 9.5 ^m	$E_\gamma/\beta = 0.88 \pm 0.08$ Mev Confirms decay scheme of Daniel et al. Z. Naturf. 8A, 447 (1953) L. Koester, Z. Naturf. 9A, 104 (1954).	a
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Mg^{28} 12 16 21.4 ^h	β^- 0.459 F-K plot linear Cl (340-Mev p) chem J. L. Olsen, G. D. O'Kelley, Phys. Rev. 93, 1125 (1954).	sl chem
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Al^{24} 13 11 2.1 ^s	γ 7.1 Mg (20-Mev p) Four lower energy γ 's α 's	scin
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N. W. Glass, J. R. Richardson, Phys. Rev. 93, 942A
(1954).

Al^{26} 13 13 6.7 ^s	Resonances	Mg^{25} (D, γ) 6.7 ^s Al^{26} $E_p = 0.3$ to 1.2
		0.39 0.81
		0.49 0.88
		0.51 0.93
		0.56 0.99
		0.59 1.04
		0.65 1.08
		0.68 1.10
		0.72 1.13
		0.78 1.20

W. E. Taylor, L. M. Russell, J. N. Cooper, Phys.
Rev. 93, 1056 (1954).

Al^{27} 13 14 stable	No γ	Al^{27} (α, α, γ) $E_\alpha = 3.0$ scin
		6. M. Temmer, N. P. Heydenburg, Phys. Rev. 93, 351 (1954).
	γ 's.	Al^{27} (n, n, γ) 0.82 scin 1.02 n γ 2.34

R. E. Garrett, F. L. Hereford, B. W. Sloope, Phys.
Rev. 92, 1507 (1953); 91, 441A (1953).

Capture γ 's	Mg (D, γ)	scin
	8.68 level $E_p = 0.454$	
	0.81 5.7	
	2.3 6.5	
	2.8 7.9	
	4.1 8.7	
	4.6	

J. C. Kluyver, G. Verploegh, Physica 20, 178 (1954).

Capture γ 's	Mg (D, γ)	scin
	8.68 level $E_p = 0.449$	
	0.8 5.9	
	2.8 8.0	
	8.90 level $E_p = 0.680$	
	0.8 5.5	
	1.0 6.2	
	2.8 8.0	

Capture γ 's	Mg (D, γ)	scin
	9.23 level $E_p = 1.011$	
	0.8 6.2	
	1.0 8.5	
	2.8	
	9.27 level $E_p = 1.053$	
	0.8 6.7	
	1.0 8.65	
	2.7 9.3	
	5.6	

J. A. Smith, J. N. Cooper, J. C. Harris, Phys. Rev.
94, 749A (1954); verbal report.

$^{128}_{13}\text{Al}$ β^- 2.88 d 21.4^h Me; s1
 13 15 <0.0% (4.66)
 2.3^m
 J.L.Olsen, G.D.O'Kelley, Phys. Rev. 93, 1125 (1954).

Si $\text{Si}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$ scin
 No γ
 G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

$^{128}_{14}\text{Si}$ Level $^{127}_{14}\text{Si}(\text{D}, \gamma)$ $E_p = 0.65$ to 2.2
 14 14 (1.78) $I = 2^+$ or 3^+ $\text{D}, \gamma(\theta)$
 stable
 H.E.Gove, E.B.Paul, G.A.Bartholomew, A.E.Litherland, Phys. Rev. 94, 749A (1954); verbal report.

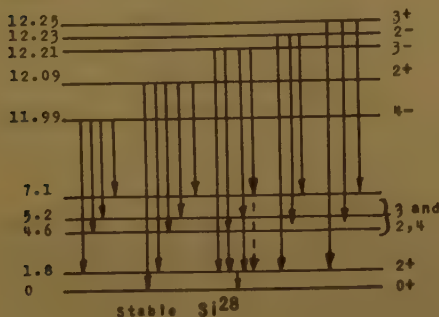
Capture γ 's $^{127}_{14}\text{Si}(\text{D}, \gamma)$ scin
 11.99 level $E_p = 0.404$ $J = 4^-$
 1.13 ? 2.8 7.3
 1.84 5.1 10.2
 (D), (7.3 γ)(θ) $b = +0.31$ No α 's observed*

12.09 level $E_p = 0.503$ $J = 2^+$
 1.18 ? 2.8 7.3 12.1
 1.84 5.1 10.3
 (D), (10.3 γ)(θ) $b = 0$ α emitting level*

12.21 level $E_p = 0.630$ $J = 3^-$
 1.13 ? 2.8 5.1 10.4
 1.84 3.5 7.6
 (D), (10.4 γ)(θ) $b = -0.11$ α emitting level*

12.23 level** $E_p = 0.652$ $J = 2^-$
 5.1 7.5 10.4 12.2
 (D), (7.6 γ)(θ) $b = -0.48$ No α 's observed*
 (D), (10.4 γ)(θ) $b = -0.12$

12.25 level** $E_p = 0.677$ $J = 3^+$
 7.5 10.4
 (D), (10.4 γ)(θ) $b = 0$ No α 's observed*
 * α yield data of J.G.Rutherglen, R.D.Smith, Proc. Phys. Soc. 66A, 800 (1953).
 **Low energy γ spectrum not measured



J.G.Rutherglen, P.J.Grant, F.C.Flack, W.M.Deuchars, Proc. Phys. Soc. 67A, 101 (1954).

$^{129}_{14}\text{Si}$ I 1/2 $^{129}_{14}\text{F}_e$ I
 14 15 stable
 G.A.Williams, D.W.McCall, H.S.Gutowaky, Phys. Rev. 93, 1428 (1954).

I 1/2 8
 R.A.Ogg, Jr., J.O.Kay, J. Chem. Phys. 22, 147, (1954).

I 1/2 Mic
 Q $<1 \times 10^{-4}$
 R.L.White, C.H.Townes, Phys. Rev. 92, 1256 (1953).

$^{131}_{17}\text{Si}$ γ 0.07% 1.26 scin
 17 17 No lower energy γ 's $\text{Si}(\text{pile n})$ chem
 2.65^h W.S.Lyon, J.J.Manning, Phys. Rev. 93, 501 (1954).

$^{132}_{14}\text{Si}$ D 14.3^d P, chem $\text{Si}(\text{pile n})$
 14 16 $\tau(^{132}\text{Si}) = 800 \sigma(^{131}\text{Si}(\text{pile n}, \gamma))$ years
 ~700^y A.Turkevich, A.Samuels, Phys. Rev. 94, 364 (1954)

$^{128}_{15}\text{P}$ β^+ 10.6 $\text{Si}(20\text{-Mev p})$ scin
 15 13 γ 7.6
 0.28^s Six or seven lower energy γ 's
 No heavy particles
 N.W.Glass, J.A.Richardson, Phys. Rev. 93, 942A (1954).

$^{129}_{15}\text{P}$ β^+ 3.945 $\text{Si}(3\text{-Mev d})$ s1
 15 14 ~3% ~2.6
 4.6^s γ 1.5% (1.28)
 H.Roderick, C.Wong, Phys. Rev. 92, 204 (1953).

$^{130}_{15}\text{P}$ τ 2.55^m 8 (13-Mev d)
 15 15 β^+ 3.23
 2.5^m No γ ($E_\gamma/\beta < 0.1$ Mev) 8
 L.Koester, Z.Naturf. 9A, 104 (1954).

τ 2.5^m $^{131}_{15}\text{P}$ ($\leq 30\text{-Mev } \gamma$)
 No γ scin
 No shorter lived activity observed
 P.Stahelin, Helv. Phys. Acta 26, 691 (1953).

$^{131}_{15}\text{P}$ Resonances $^{127}_{15}\text{P}(\alpha, \text{D})$
 15 16 (4.0) $\Gamma = 0.38$ cc
 stable (4.4) $\Gamma = 0.80$

R.R.Roy, C.Godeau, Phil. Mag. 44, 1184 (1953).

p31 15 16 stable	No γ	$P^{31}(\alpha, \alpha\gamma)$	$E_\alpha = 3.0$	scin	Cl	No γ	$Cl(\alpha, \alpha\gamma)$	$E_\alpha = 3.0$	scin
	G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).					G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).			
p32 15 17 14.3 ^d	Inner bremsstrahlung spectrum (0.08 to 0.9) has allowed shape				C132 17 15 0.31 ^a	β^+ γ	9.4 4.77	S(20-Mev D)	scin
	M.Goodrich, W.B.Payne, Phys. Rev. 94,405 (1954).					Three lower energy γ 's α 's N.W.Glass, J.R.Richardson, Phys. Rev. 93,942 A (1954).			
p33 15 18 24.4 ^d	τ β^-	24.4 ^d 0.249	$S^{33}(\text{pile n})$	chem sl	C133 17 16 2.8 ^a	γ	$\sim 0.3\%$ 2.85 ^a		
	R.T.Nichols, E.N.Jensen, Phys. Rev. 94, 369 (1954).					W.E.Meyerhof, G.Lindstrom, Phys. Rev. 93, 949A (1954); ^a verbal report.			
S	No γ	$S(\alpha, \alpha\gamma)$	$E_\alpha = 3.0$	scin	C134 17 17 1.5 ^a	τ_2	1.58 ^a	d 32.4 ^a Cl	chem
	G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).					W.Arber, P.Stähelin, Helv. Phys. Acta 26,584A,691 (1953); Phys. Rev. 92, 1076 (1953).			
s32 16 16 stable	Capture γ 's	$P^{31}(D, \gamma)$	$E_p = 0.4$ to 1.2	scin	C135 17 18 stable	$\nu(Cl^{35})/\nu(Cl^{37}) = 1.2684$	1	HgCl ₂	quad res
		9.4 level				H.G.Dehmelt, H.G.Robinson, W.Gordy, Phys. Rev. 93, 480 (1954); 93, 920A (1954).			
		0.7	2.2	5.0	8.0				
		1.4	3.8	7.4					
		9.5 level				A37 18 19 34 ^d	E_{d1a}	0.82	scin
		2.2	4.3	5.5	7.6		From continuous γ endpoint		
		9.6 level					S.E.Singer, W.S.Emmerich, J.D.Kurbatov, Phys. Rev. 94,113,779A (1954).		
		0.6	3.9	5.4	7.6				
		2.2							
		9.85 level				A38 18 20 stable	Levels	$Cl^{35}(\alpha, D)$	$E_\alpha = 7.45$
		2.2	5.3	8.0	10.1			2.13	a
		4.5						3.73	
		9.98 level					A.Z.Kranz, W.W.Watson, Phys. Rev. 91,1472 (1953).		
		2.2	4.4	5.5	8.0				
	J.A.Smith, J.N.Cooper, J.C.Harris, Phys. Rev. 94, 749A (1954); verbal report.				K	No γ	$K(\alpha, \alpha\gamma)$	$E_\alpha = 3.0$	scin
						G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351 (1954).			
s33 16 17 stable	Level	$A^{36}(n, \alpha)$	$E_n = 2.15$ to 4.40	pc	K38 19 19 0.95 ^a	τ_B β^+	0.95 ^a (4.57) ^a	$K(\leq 31\text{-Mev } \gamma)$	
	(Incorrectly given as 1.1 in NSA 7 No. 24B)					$\sigma(0.95^a K) / \sigma(7.7^a K) = \sim 1$ $E_\gamma \leq 16$ to $E_\gamma \leq 31$ Suggest this is $J = 0^+$ and $T = 1$ state ^a Formerly assigned to K^{37}			
	B.J.Toppel, S.D.Bloom, Phys. Rev. 91,473A (1953).					P.Stähelin, Helv. Phys. Acta 26,691 (1953); Phys. Rev. 92,1076 (1953). ^a F.I.Soley, D.J. Zaffarano, Phys. Rev. 84,1059 (1951).			
s35 16 19 87 ^d	No β^- 's with $E_\beta < 10$ kev found from $C_2H_6S^{35}H$ in cc								
	G.J.Plain, H.L.Morrison, P.H.Pitkanen, F.T. Rogers, Jr., Phys. Rev. 92,529A (1953).								
	μ	1.00	OCS^{39}	Mic	K39 19 20 stable	μ	+0.39087	1	KCO ₂ H
	Assumed positive					I			
	B.F.Burke, M.W.P.Strandberg, V.W.Cohen, W.S. Koski, Phys. Rev. 93, 193 (1954).					E.Brun, J.Oesser, H.H.Staub, C.G.Telschow, Phys. Rev. 93, 172 (1954).			

K^{40} $A^{40}/K^{40} = 0.0537 \pm 0.0014$ for one of feldspar
 19 21 samples for which Russell et al found
 1.3x10⁹y 0.037 \pm 0.004. Estimate feldspar age
 < Russell value, use same τ_{total} , conclude
 $\epsilon/\beta^- \sim 0.13$

G.J.Wasserburg, R.J.Hayden, Phys. Rev. 93, 645
 (1954); * R.D.Russell, H.A.Shillibeer,
 R.M.Farquhar, A.K.Mousuf, Phys. Rev. 91, 1223
 (1953).

K^{41} μ -0.21453 3 KCO_2H I
 19 22 $\nu(K^{41})/\nu(K^{39}) = 0.54886$ 8
 stable E.Brun, J.Oesser, H.H.Staub, C.G.Telschow,
 Phys. Rev. 93, 172 (1954).

K^{42} No (2.04 β) (1.51 γ) polarization-direction
 19 23
 12.5^h D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev.
 92, 1191 (1953); 90, 370A (1953)

K^{44} τ 22.0^m $Ca^{44}(\leq 20\text{-Mev } n)\text{chem}$
 19 25 β^- 1.5 scin
 22^m 4.9
 1.13 scin
 2.07
 2.48
 3.6 ?

Other unresolved γ 's with $E_\gamma < 0.5$

B.L.Cohen, Phys. Rev. 94, 117 (1954).

Ca $Ca(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$ scin
 No γ

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,
 351 (1954).

Ca^{47} τ 5.4^d 1 $Ca^{46}(\text{pile } n)$ chem
 20 27 β^- 0.46
 4.8^d 40% 1.40
 γ 0.1495
 0.234
 0.495
 0.80
 1.30

(> 0.6 β) (~ 0.2 γ)

J.W.Cork, J.M.Lebianc, M.K.Brice, W.H.Nester,
 Phys. Rev. 92, 367 (1953).

τ 4.3^d 2 $Cr(420\text{-Mev } p)\text{chem}$
 β^- 81% 0.685 sl
 19% 2.060 F-K plot linear

L.Marquez, Phys. Rev. 92, 1511 (1953).

β^- ~80% 0.8 $Ca(26\text{-Mev } d)\text{chem}$; a
 ~20% 2.0 $Tl(26\text{-Mev } d)\text{chem}$
 γ 1.3 scin

A.H.W.Aten, Jr., E.Grouell, W.J.van Dijk, Physica
 19, 1049 (1953).

Sc^{40} τ 0.22^s $Ca(15.9 \pm 1.0\text{-Mev } p)$
 21 19 β^+ 9.0 scin
 0.22^s γ 3.75
 No heavy particles No other γ

N.W.Glass, J.R.Richardson, Phys. Rev. 93, 942A
 (1954).

Sc^{43} γ 25† 0.375 scin
 21 22 †Percent of β^+
 4.0^h

R.H.Mussbaum, R. van Lieshout, A.H.Wapstra, Phys.
 Rev. 92, 207 (1953).

Sc^{44} 0.511 γ /1.16 $\gamma = 1.96 \pm 0.15$ scin
 21 23 Na²² comparison ($\epsilon = 10\%$)
 4.0^h $\beta^+ / (\epsilon + \beta^+) = 0.98 \pm 0.08$
 Theory gives $\beta^+ / (\epsilon + \beta^+) = 0.98$

H.Langevin, M.Marty, J. Phys. Radium 15, 127
 (1954).

Sc^{45} $Sc^{45}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$ scin
 21 24 No γ
 stable G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,
 351 (1954); priv. comm.

Sc^{46} β^- 0.10% 1.25 log $f_0 t = 11.3$ sl
 21 25 Shape fitted by C_{27} ($\Delta I = 2, \text{no}$) not ($\Delta I = 3, \text{no}$)
 84^d G.L.Keister, F.H.Schmidt, Phys. Rev. 93, 140
 (1954); 91, 483A (1953).

γ (0.88) $\alpha = 1.3 \times 10^{-4}$ sl ce^-
 (1.11) $\alpha = 2.6 \times 10^{-4}$

E.F.Sturcken, Z.O.Friel, A.H.Weber, Phys. Rev.
 93, 1033 (1954).

No delayed $\gamma\gamma$ ($\tau < 10^{-6}$ s)

H.S.Murdoch, A.J.Webb, Proc. Phys. Soc. 67A,
 286 (1954).

Sc^{47} τ 3.40^d 5 d 4.8^dCa
 21 26 β^- 28% 0.280 F-K plot linear sl
 3.43^d 72% 0.490 F-K plot linear
 γ ~0.22 sl ce^-

L.Marquez, Phys. Rev. 92, 1511 (1953).

τ 3.40^d 5 d 4.8^dCa
 β^- 0.6%
 γ 0.1595 K/LM ~ 10
 (0.64 β) (0.16 γ)

J.W.Cork, J.M.Lebianc, M.K.Brice, W.H.Nester,
 Phys. Rev. 92, 367 (1953).

Sc⁴⁸
 21 27 γ 100† (0.98) Ti(18-Mev n) scin
 1.83^d 100† 1.04 γ^{48} comparison
 100† (1.32)

 $\gamma\gamma$

H. Casson, L.S. Goodman, V.E. Krohn, Phys. Rev. 92, 1517 (1953).

(1.04 γ) (0.98 γ) (θ) I = 6, 4, 2, 0

C.E. Whittle, P.S. Jastram, Phys. Rev. 92, 205, (1953).

Sc⁴⁹
 21 28 τ 57^m Ca(13-Mev d) chem
 57^m β^- 2.00 a
 No γ ($E_\gamma/\beta < 0.05$ Mev) a

L. Koester, Z. Naturf. 9A, 104 (1954).

Ti
 γ Ti($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$
 0.155 scin
 0.433

G.M. Temmer, H.P. Heydenburg, Phys. Rev. 93, 351 (1954).

Ti⁴⁴
 22 22 τ 2.7^y Sc⁴⁵ (30-Mev p) chem
 2.7^y γ 0.16 scin
 D 4.0^h Sc chem Not D 2.4^d Sc

R.A. Sharp, R.M. Diamond, Phys. Rev. 93, 358 (1954).

Ti⁴⁵
 22 23 No 0.48 γ (< 1.5% of β^+) scin, $\beta\gamma$
 3.07^h R.M. Mussbaum, R. van Lieshout, A.H. Wapstra, Phys. Rev. 92, 207 (1953).

Ti⁴⁷
 22 25 I 5/2 Ti⁴⁷Cl₄ I
 stable μ -0.7871[±] 1
 *From ν (Ti⁴⁷)/ ν (D) = 0.36721 θ
 Also ν (Ti⁴⁷)/ ν (Cl³⁵) = 0.57493 θ
 C.D. Jeffries, Phys. Rev. 92, 1262, 1096A (1953).

Ti⁴⁹
 22 27 μ 7/2 Ti⁴⁹Cl₄ I
 stable μ -1.1023[±] 2
 *From ν (Ti⁴⁹)/ ν (D) = 0.36731 θ
 Also ν (Ti⁴⁹)/ ν (Cl³⁵) = 0.57508 θ
 C.D. Jeffries, Phys. Rev. 92, 1262, 1096A (1953).

Capture γ 's Ti(n, γ) sl pe⁻
 0.346[°]
 0.511 (annihilation γ 's)[°]
 1.385
 1.500[°]
 1.590[°]
 1.785[°]

Mass assignment from intensity

Observed range E_γ 0.3 to 2.0

H.T. Motz, Phys. Rev. 93, 925A (1954); *verbal report.

Ti⁵¹
 22 29 No 0.48 γ (< 3% of 0.325 γ) scin
 5.8^m R.M. Mussbaum, R. van Lieshout, A.H. Wapstra, Phys. Rev. 92, 207 (1953).

γ^{47}
 23 24 τ 31.1^m Ti(13-Mev d) chem
 31.1^m β^+ 1.90 a
 No γ ($E_\gamma/\beta < 0.08$ Mev) a

L. Koester, Z. Naturf. 9A, 104 (1954).

No γ (< 20%) Ti(26-Mev d) chem; a

A.H.W. Aten, Jr., J. Kooi, B. de Vries, A.L. Veenendaal, Physica 19, 1051 (1953).

γ^{48}
 23 25 β^+ 0.692 Cr(420-Mev p) chem
 16.0^d No 0.82 β^+ (< 0.2%) sl
 No > 0.87 β^+ (< 0.1%)

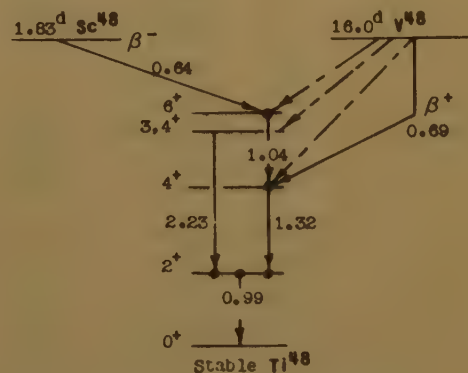
L. Marquez, Phys. Rev. 92, 1511 (1953).

$\gamma\gamma(\theta)$ I = 4, 2, 0

D.G. Alkhazov, I. Kh. Lemberg, A.P. Grinberg, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 487 (1953).

(2.2 γ) (0.99 γ) Cr(22-Mev d) chem scin
 $\gamma\gamma$ in 10 \pm 5% of disintegrations

$\beta^+/(1.32\gamma) = 0.49 \pm 0.04$ assuming Na²² $\beta^+/\epsilon = 19$



H. Casson, L.S. Goodman, V.E. Krohn, Phys. Rev. 92, 1517 (1953).

γ^{50}
 23 27 I 6 para
 >10¹²y $\mu(\gamma^{50})/\mu(\gamma^{51}) = 0.6501 \pm 4$

C. Kikuchi, M.H. Strvetz, V.W. Cohen, Phys. Rev. 92, 109 (1953); Phys. Rev. 88, 142 (1952).

γ^{51}
 23 28 q ~0.3 8
 stable K. Murakawa, T. Kamei, Phys. Rev. 92, 325 (1953).

V⁵¹ 23 28 stable	γ	$V(\alpha, \alpha'\gamma)$ 0.320	$E_\alpha = 3.0$	scin	Cr⁴⁹ 24 25 41.8	β^+ γ	1.47 0.063 0.091 0.150	$\alpha = 0.14$ $\alpha = 0.06$ $\alpha = 0.16$	M1 M1 E2	TI (45-Mev α) chem sl ce ^a scin
		G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).					15 \dagger 30 \dagger 14 \dagger			
		No 0.73 β^+ No 0.61 γ (<4 \dagger) No 1.57 γ								
		R.H.Nussebaum, A.H.Wapstra, G.J.Nijgh, L.Th.Ornstein, W.F.Verster, Physica 20, 163 (1954); Phys. Rev. 92, 207 (1953).								
V⁵² 23 29 3.77 ^m	τ	3.77 ^m	Cr (fast n)	chem	Cr⁵¹ 24 27 27 ^d		No 0.48 γ (<3% of 0.328 γ)			scin
		No low energy ce ⁻ sl					R.H.Nussebaum, R. van Lieshout, A.H.Wapstra, Phys. Rev. 92, 207 (1953).			
		No 2.6 ^m activity								
		G.Weber, Z.Naturf. 9A, 115 (1954).								
	τ	3.75 ^m	V (pile n)		Cr⁵² 24 28 stable	Level	Cr (n, n' γ)	$E_n = 2.5$		scin
	β^-	~2.6		a $\beta\gamma$		γ	1.42			
	γ	1.44					Assignment from agreement with 6.0 ^d Mn ⁵² γ			
		No ce ⁻ (2.6 β)(1.44 γ)								
		No 2.6 ^m nor 16 ^h activity found for V ⁵²								
		J.M.Lebianc, J.M.Cork, S.B.Burson, W.C.Jordan, Phys. Rev. 93, 1124 (1954).								
	τ	3.77 ^m	V (13-Mev d)			Level	Cr (n, n' γ)	$E_n = 3.9$		scin
	β^-	2.47		a		γ	1.43			
	$E_\gamma/\beta = 1.5$ Mev			a			Assignment from agreement with 6.0 ^d Mn ⁵² γ			
		L.Koester, Z.Naturf. 9A, 104 (1954).								
		M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954); 92, 1097A (1953).								
	Levels	V (d, D)	$E_d = 5.74$	BT	Mn⁵¹ 25 26 45 ^m	τ	45.2 ^m	Cr (13-Mev d)	chem	
	93 \dagger	9.8.				β^+	2.16		a	
	36 \dagger	0.13	48 \dagger	2.13		No γ ($E_\gamma/\beta < 0.1$ Mev)			a	
	7 \dagger	0.42	33 \dagger	2.15						
	50 \dagger	0.78	40 \dagger	2.31						
	75 \dagger	0.83	39 \dagger	2.42						
	21 \dagger	1.40	10 \dagger	2.46						
	13 \dagger	1.48	22 \dagger	2.53						
	100 \dagger	1.55	21 \dagger	2.85						
	50 \dagger	1.75	20 \dagger	3.00						
	38 \dagger	1.79	41 \dagger	3.05						
	20 \dagger	1.84	52 \dagger	3.19						
	43 \dagger	2.09	29 \dagger	3.31						
		J.E.Schwager, L.A.Cox, Phys. Rev. 92, 102 (1953).								
V⁵³ 23 30 23 ^h	τ	23 ^h	Cr ⁵³ (pile n)	chem	Mn⁵⁴ 25 29 320 ^d	τ_a	324 ^d	Fe ⁵⁴ (pile n)	chem	
	β^-	0.6		a		γ	0.83			
	γ 's			scin			G.H.Stafford, L.H.Stein, Nature 172, 1103 (1953)			
		R.K.Sheline, J.R.Wilkinson, Phys. Rev. 94, 729 (1954).								
Cr		Cr ($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$	scin	Mn⁵⁵ 25 30 stable	q	~0.4			8
	No γ						K.Murakawa, T.Kamel, Phys. Rev. 92, 325 (1953).			
		G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).								
Cr	Resonance	Cr (n)	$E_n = 3$ to 10^5 ev 3800 ev $\sigma_\alpha \Gamma^2 = 8.55 \times 10^7$ time of flight			γ	Mn ⁵⁵ ($\alpha, \alpha'\gamma$) 0.128	$E_\alpha = 3.0$		scin
		E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702 (1953).								
		M.R.Metzger, W.B.Todd, Phys. Rev. 92, 904 (1953)								
		(1.8) (0.88 γ) (θ) I = 2, 2, 0 (2.1 γ) (0.88 γ) (θ) I = 2, 2, 0								
		(2.1) M1 96% E2 2% $\gamma\gamma(\theta)$ (2.1) M1 92% E2 8%								

Mn⁵⁶
 25 31
 2.58^h
 (0.845 γ) (1.81 γ , 2.13 γ)
 NO (1.81 γ) (2.13 γ)
 E. Gernagnoli, A. Malvicini, L. Zappa, Nuovo
 Cim. 10, 1388 (1953).

Fe
 γ Fe ($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$
 0.122 scin

G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

γ Fe ($n, n'\gamma$) $E_n = 14$ scin
 0.85 1.44 $n'\gamma$
 1.29 2.10 Cf Fe⁵⁶

R.E. Garrett, F.L. Hereford, B.W. Sloope, Phys.
 Rev. 92, 1507 (1953); 91, 441A (1953).

Fe⁵³
 26 27
 9^m
 γ 30 \dagger 0.370 scin
 \dagger Percent of β^+

R.H. Nussbaum, R. van Lieshout, A.H. Wapstra,
 Phys. Rev. 92, 207 (1953).

Fe⁵⁵
 26 29
 2.9^y
 E_{dis} 0.23 scin
 From continuous γ endpoint

L. Medansky, F. Rasetti, Phys. Rev. 94, 407 (1954).

S.E. Singer, W.S. Emerich, J.D. Kurbatow, Phys.
 Rev. 94, 113, 779A (1954).

Fe⁵⁶
 26 30
 stable
 Level Fe ($n, n'\gamma$) $E_n = 2.5$
 γ 0.9 scin
 Assignment from agreement with 2.56^h Mn⁵⁶ γ

E.A. Eliot, D. Hicks, L.E. Seghian, H. Halban,
 Phys. Rev. 94, 144 (1954).

γ Fe ($n, n'\gamma$) $E_n = 3.9$ scin
 0.85
 1.80
 2.15

Assignment from agreement with 2.56^h Mn⁵⁶ γ 's

M.A. Rothman, C.E. Handeville, Phys. Rev. 93,
 796 (1954); 92, 1097A (1953).

Fe⁵⁹
 26 33
 45^d
 τ 45.0^d 2 Fe (pile n) chem
 Counted for 16 days differential ic

J. Tobellon, J. phys. radium 14, 553 (1953).

Co⁵⁵
 27 28
 18^h
 β^+ 2.3 \dagger 0.26 Fe (11.6-Mev d) chem
 4.9 \dagger 0.53 sl
 39.5 \dagger 1.03
 53.3 \dagger 1.500

$ce^-/\beta^+ (x10^5)$

γ 2 \dagger 0.253 scin
 28 \dagger 0.477 11.0 sl ce^-
 166 \dagger 0.935 12.4
 26 \dagger 1.41 3.5
 0.6 \dagger 1.84 scin
 4 \dagger 2.17

R.S. Caird, A.C.G. Mitchell, Phys. Rev. 94, 412 (1954).

Co⁵⁶ β^+ 4%* 0.44 sl
 27 29 96%* 1.50 Fe⁵⁶ (20-Mev d) chem
 80^d
 γ 100 \dagger * 0.835 scin
 55 \dagger * 1.23
 24 \dagger * 1.74
 12 \dagger * 2.31
 14 \dagger * 2.60
 24 \dagger * 3.25

(0.511 γ) (0.835 γ , 1.23 γ) *

M. Sakai, J. Dick, J.D. Kurbatov, Phys. Rev. 94,
 779A (1954); * verbal report.

Co⁵⁷
 27 30
 270^d
 γ 15 \dagger 0.123 $\frac{a_K}{0.14}$ $\frac{K/LM}{\sim 8}$ (E)2
 1 \dagger 0.138 0.011 ~ 8 (M)1
 Fe(d) chem $\sqrt{2}$

D.E. Alburger, M.A. Grace, Proc. Phys. Soc. 67A,
 280 (1954).

Co⁵⁹ q 0.5 8
 27 32
 stable K. Murakawa, T. Kamet, Phys. Rev. 92, 325 (1953).

Co⁵⁹ ($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$
 No γ scin

G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

Co⁶⁰ $|\mu|$ 3.5 $\gamma(\theta, T)$
 27 33
 5.2^y

B. Bleaney, J.M. Daniels, M.A. Grace, H. Halban,
 M. Kurti, F.N.H. Robinson, F.E. Simon, Proc. Roy.
 Soc. 221A, 170 (1954).

β^- 0.15% 1.48 log $f_0 t = 12.6$ sl
 Shape fitted by C_{2T} ($\Delta I = 2, no$) not ($\Delta I = 3, no$)

G.L. Keister, F.H. Schmidt, Phys. Rev. 93, 140 (1954).

γ (1.17) $\tau \sim 10^{-11}s$
 (1.33) $\tau \sim 10^{-11}s$

Z. Bay, V.P. Henri, F. McLernon, Phys. Rev. 94,
 780A (1954); verbal report.

γ (1.33) $\tau < 7 \times 10^{-10}s$ $\gamma\gamma$

S. Gorodetzky, A. Knipper, R. Armbruster, A.
 Gallmann, J. phys. radium 14, 550 (1953).

Resonance **Co⁵⁹** (n) chopper
 134 ev $J = 3$ $\Gamma = 6.5$ ev

F.G.P. Seldi, Phys. Rev. 93, 931A (1954).

Ni Ni ($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$
 No γ scin

G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

⁵⁹ Ni 28 31 7.5x10 ⁵ y	E_{d1s} 1.07 From continuous γ endpoint No 0.511 γ ($<4 \times 10^{-3}\%$)	scin	⁶⁶ Cu 29 37 5.10 ^m	τ 5.20 ^m β^- 90% 2.60 $E_{\gamma}/\beta = 0.10$ Mev	Cu(13-Mev d)	a a
S.E.Singer, W.S.Emmerich, J.D.Kurbatov, Phys. Rev. 94, 113, 779A (1954).			L.Koester, Z.Naturf. 9A, 104 (1954).			
⁶⁰ Ni 28 32 stable	γ Ni(n,n' γ) 0.90? 1.36 Assignment from agreement with ⁶⁰ Cu γ 's q.v. M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954).	$E_n = 3.9$ scin	⁶⁵ Zn 30 35 245 ^d	τ 245.0 ^d 8 Counted for 60 days	Zn(pile n) chem differential ic	
			J.Toballien, J. Phys. radium 14, 553(1953).			
⁶³ Ni 28 35 85 ^y	β^- 0.062 $\Delta I = 2$, yes shape EA Y.Kobayashi, G.Miyamoto, S.Mori, J. Phys. Soc. Japan 8, 684 (1953).	EA	ϵ_{gs}^{gs} 54.2% $\epsilon_A^+ : \beta^+ : \text{ce}^- = 10,300 : 361 : 2.35$			
			J.F.Perkins, S.K.Haynes, Phys. Rev. 92, 687, 1096A(1953).			
⁶⁴ Cu	$\text{Cu}(n, n'\gamma)$ No γ G.M.Temmer, M.P.Heydenburg, Phys. Rev. 93, 351 (1954).	$E_n = 3.0$ scin	β^+ 0.327 Cu(d,2n) chem; sl γ (1.11) $\alpha = 1.8 \times 10^{-4}$ No 0.20 γ ($<3 \times 10^{-4}$) $\gamma/\beta^+ = 28 \pm 7$ $\epsilon_{gs}/\beta^+ = 34 \pm 7$ (calc) thus $\Delta L = 0$ transition			sl
Level $\text{Cu}(n, n'\gamma)$ $E_n = 3.8$ γ ~0.9 scin M.A.Rothman, M.S.Hans, C.E.Mandeville, Phys. Rev. 94, 791A (1954).			R.Bouchez, P.Hubert, M.Perrin, M.Sakai, J. phys. radium 14, 29A; 14,273(1953); Compt. rend. 236, 1249 (1953).			
γ	$\text{Cu}(n, n'\gamma)$ 0.9 ? 1.13	$E_n = 14$ scin 1.53 n γ 2.19	β^+ 0.325 γ 1.122 $\alpha = 1.7 \times 10^{-4}$ s $\gamma/\beta^+ = 33 \pm 3$ s ce^- s pe^-			s s s
R.E.Garrett, F.L.Herford, B.W.Sloope, Phys. Rev. 92, 1507 (1953); 91,441A (1953).			A.A.Bashilov, N.M.Anton'eva, D.C.Broder, B.S.Dzhelepov, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 468 (1953); Chem. Abstr. 48-2488h (1954).			
⁶⁰ Cu 29 31 23 ^m	τ 23.4 ^m Ni(26-Mev d) β^+ 73 \dagger 2.01 sl 19 \dagger 2.96 7 \dagger 3.84 γ 15 \dagger 0.81 scin 100 \dagger 1.33 80 \dagger 1.8 $E_{d1s} = 6.19$ No 1.17 γ ($<10\%$) R.Van Lieshout, R.H.Nussbaum, G.J.Mijgh, A.H.Wapstra, Phys. Rev. 93, 255 (1954).	sl	β^+ 0.320 $\gamma/\beta^+ = 24 \pm 1$ Na^{22} comparison ($\epsilon = 10\%$) scin T.Yussa, Compt. rend. 237, 1077 (1953).			sl
			$\gamma/\beta^+ = 31 \pm 5$ scin			
			D.Mader, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).			
⁶³ Cu 29 34 stable	Q -0.13 8 H.Kopfermann, A.Steudel, S.Wagner, W.Walcher, Nachr. Akad. Wiss. Göttingen, Math.-physik. Kl. IIIa, No. 1 (1953).	8	γ (1.11) $\alpha = 2.2 \times 10^{-4}$ sl Cpt			
			E.F.Sturcken, Z.0 ^o Friel, A.H.Weber, Phys. Rev. 93, 1053 (1954).			
⁶⁴ Cu 29 35 12.6 ^h	γ 1.35 s pe^- $\gamma/\beta^+ = 0.042$ B.S.Dzhelepov, M.M.Zhukovskii, V.P.Frikhodtseva, Yu. V.Khol'mov, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 511 (1953); Chem. Abstr. 48-2488d (1954).	s pe^-	Level $\text{Cu}(p, n)$ $E_p = 2$ to 4 0.86 "Threshold" neutrons detected C.F.Cook, T.W.Bonner, Phys. Rev. 94, 807A(1954).			

Zn^{67}
 $30 \quad 37$
 stable γ $Zn(\alpha, \alpha' \gamma)$ $E_{\alpha} = 3.0$ scin
 0.093
 0.182
 G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Ga^{65}
 $31 \quad 34$
 8^m τ_2 8.0^m $Cu(\alpha), Zn(d)$ chem
 β^+ not $Zn(p)$ s
 No γ sl $ce^- pe^-$ scin
 B.Crasemann, Phys. Rev. 93, 1034 (1954).

Zn^{69}
 $30 \quad 39$
 14^h γ 0.439 $\alpha_K = 0.040$ M4 s
 $K/LM = 7.5$
 V.M.Dolishnyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusakov, Doklady Akad. Nauk SSSR 92, 1141 (1953); NSF-tr-229

Ga^{66}
 $31 \quad 35$
 9.4^h γ $2\frac{1}{2}$ 0.83 $22\frac{1}{2}$ 2.75 scin
 $30\frac{1}{2}$ 1.04 $2\frac{1}{2}$ 3.24
 $3\frac{1}{2}$ 1.37 $3\frac{1}{2}$ 3.41
 $1.58 ?$ $2\frac{1}{2}$ 3.78
 $4\frac{1}{2}$ 1.93 $2\frac{1}{2}$ 4.12
 $6\frac{1}{2}$ 2.18 $5\frac{1}{2}$ 4.33
 $2\frac{1}{2}$ 2.40 $2\frac{1}{2}$ 4.83
 $(<0.5\beta)$ (1.04, 1.37, 2.18, 2.75, 3.24, 3.41 γ 's)
 $(<0.5\beta)$ (2.40, 3.78 γ 's)
 $(>1.0\beta)$ (1.04, 1.37, 2.40, 2.75 γ 's)
 $(>2.2\gamma)$ (1.04, 1.58 γ 's)
 \dagger Photons per 100 disintegrations assuming 40% ϵ

Zn^{69}
 $30 \quad 39$
 52^m β^- 0.92 d $14^h Zn$ s
 V.M.Dolishnyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusakov, Doklady Akad. Nauk SSSR 92, 1141 (1953); NSF-tr-229.

Levels $Zn^{68}(d, p)$
 g.s. $l_n = 1$ d, p(θ)
 (0.439) $l_n = 4$

F.S.Eby, R.D.Hill, W.K.Jenschke, Phys. Rev. 93, 925A (1954).

Ga Relative abundances
 A 69 71
 % 60.5 39.5

S.Anklin, V.M.Dibeler, J. Chem. Phys. 21, 1890 (1953).

Ga^{67}
 $31 \quad 36$
 78^h γ $100\frac{1}{2}$ $\left\{ \begin{array}{l} (0.090) \\ (0.082) \\ (0.182) \end{array} \right.$ scin
 $55\frac{1}{2}$ $\left\{ \begin{array}{l} (0.21) \\ (0.30) \end{array} \right.$
 $39\frac{1}{2}$ (0.30)
 $5\frac{1}{2}$ (0.39)

D.Maeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).

$Ga(\alpha, \alpha' \gamma)$ $E_{\alpha} = 3.0$ scin
 No γ
 G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Resonances $Ga(n)$ $E_n = 0.8$ to 10^5 ev
 E_0 (ev) $\sigma_{\alpha} \sqrt{v}$ time of flight
 102 2,200
 310 170,000
 5007
 10007

E.Melkonian, W.W.Havens, Jr., L.J.Rainwater, Phys. Rev. 92, 702 (1953).

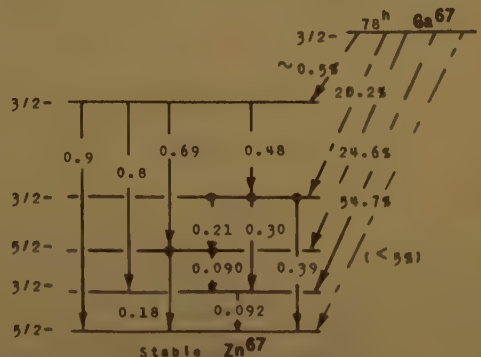
Ga^{66}
 $31 \quad 34$
 15^m τ_1 15^m $Cu(\alpha)$ chem
 γ IT? 0.052 α large sl ce^- , scin
 0.092
 0.114

B.Crasemann, Phys. Rev. 93, 1034 (1954).

τ_1 15^m $Zn(13-Mev d)$ chem
 β^+ 2.1 s
 No γ ($E_{\gamma}/\beta < 0.3$ Mev) s
 $[\beta^+ \text{ in } 8^m Ga^{65} ?]$ s

L.Koester, Z.Naturf. 9A, 104 (1954).

No β^+ ($< 0.01\%$)
 γ $7\frac{1}{2}$ 0.090 scin
 $93\frac{1}{2}$ 0.092 $\alpha = 0.54$ $\tau = 9.5^{\mu s}$
 $44\frac{1}{2}$ 0.182 $\sim 0.2\frac{1}{2}$ 0.48
 $3\frac{1}{2}$ 0.21 $\sim 0.1\frac{1}{2}$ 0.69
 $28\frac{1}{2}$ 0.30 $\sim 0.2\frac{1}{2}$ ~ 0.8
 $10\frac{1}{2}$ 0.39 $\sim 0.6\frac{1}{2}$ ~ 0.9
 (0.69γ) (0.18 γ) (0.21 γ) (0.18 γ)
 (0.48γ) (0.39 γ , 0.30 γ , 0.18 γ , 0.21 γ)
 0.09γ , 0.21 γ , 0.30 γ precede 0.092 γ
 No γ follows 0.082 γ
 (0.21γ) (0.18 γ) (θ) $I = 3/2, 5/2, 5/2$



W.E.Meyerhof, L.G.Mann, H.I.West, Jr., Phys. Rev. 92, 758 (1953).

$^{68}_{31}\text{Ga}$ τ $^{68\text{m}}_{31}\text{Ga}$ Zn(13-Mev d) chem $^{76}_{33}\text{As}$ τ 26.4^h As(pile n) chem
 β^+ 1.90 a β^- 3% 0.35 sl
 $^{68\text{m}}_{31}\text{Ga}$ NO γ ($E_\gamma/\beta < 0.1$ Mev) a 26.5^h 6% 1.20
 6% 1.75
 32% 2.40
 53% 2.96 $\Delta I = 2$, yes shape
 100% 0.555 sl pe^-
 9% 0.648
 23% 1.210
 1.6% 1.410
 5% 2.06

L.Koester, Z.Naturf. 9A, 104 (1954).

$^{69}_{31}\text{Ga}$ $q(^{69}\text{Ga})/q(^{71}\text{Ga}) = 1.5867$ GaCl_3 quad res
 $^{69}_{31}\text{Ga}$ stable H.G.Dohmelt, Phys. Rev. 92, 1240 (1953).

$^{67}_{32}\text{Ge}$ τ 19^m Zn(52-Mev α) chem
 β^+ 3.4 a
 $^{67}_{20}\text{Ge}$ γ 0.17 scin

A.H.W.Aten, Jr., T. de Vries-Hamerling, L. Lindner, Physica 19, 1046 (1953).

$^{73}_{32}\text{Ge}$ μ -0.8768 I GeCl_4 I
 $^{73}_{32}\text{Ge}$ stable $\nu(^{73}\text{Ge})/\nu(\text{D}) = 0.22725$ 3
 C.D.Jeffries, Phys. Rev. 92, 1262 (1953).

$\text{Ge}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$
 γ 0.068 scin

G.M.Temmer, M.P.Haydenburg, Phys. Rev. 93, 351 (1954).

$^{75}_{32}\text{Ge}$ γ $\sim 2.2^+$ (0.067) $< 0.03^+$ (0.405) scin
 $^{75}_{32}\text{Ge}$ $< 0.15^+$ (0.138) 2.5% 0.427%
 $^{75}_{32}\text{Ge}$ 12% (0.203) 2.3% 0.48%
 $^{75}_{32}\text{Ge}$ 100% (0.269) 1.8% 0.628%
 (0.427, 0.087) (0.203)* No other $\gamma\gamma$
 (~0.86) (0.269)

A.W.Schardt, J.P.Welker, Phys. Rev. 93, 916A (1954); *verbal report.

$^{73}_{33}\text{As}$ γ (0.0135) $\alpha \geq 1300$ $\tau = 4.6 \mu\text{s}$ scin
 $^{73}_{33}\text{As}$ (0.0539) $\alpha = 4.7$ $\tau = 0.33 \mu\text{s}$
 0.0188% follows 0.064%
 No 0.081% ($< 0.2\%$ of 0.064%) No 0.0674%
 All ϵ to 0.0674 level

J.P.Welker, A.W.Schardt, G.Friedlander, J.J. Hewland, Jr., Phys. Rev. 92, 401 (1953); 91, 484 (1953); *E.C.Campbell, ibid.

γ (0.054) $\alpha \sim 8$ scin, pc

R.Barloutaud, R.Ballini, M.Sartori, Compt. rend. 237, 886 (1953).

$^{75}_{33}\text{As}$ γ $^{75}_{33}\text{As}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$
 0.068 scin
 0.199
 0.281

G.M.Temmer, M.P.Haydenburg, Phys. Rev. 93, 351 (1954).

P. Hubert, Ann. Phys. 8, 662 (1953).

β^+ 0.67 B
 $\beta^+/\beta^- \sim 10^{-3}$ cc

B.B.Murray, J.D.Kurbatov, Phys. Rev. 94, 780A (1954).

γ (0.55) E2
 (2.41) (0.55) polarization-direction

D.R.Hamilton, A.Lemonick, F.M.Pipkin, Phys. Rev. 92, 1191 (1953); 90, 370A (1953).

Capture γ 's	$^{75}_{33}\text{As}(n, \gamma)$	s pr
2%	4.58	1% 6.05
1%	4.77	2% 6.38
1%	4.97	2% 6.85
2%	5.17	2% 7.05
1%	5.41	0.5% 7.90

Also graph $E_\gamma = 2.5$ to 8
 †Photons per 100 n captures

G.A.Bartholomew, S.B.Kinsey, Can. J. Phys. 31, 1025 (1953).

Capture γ 's	$^{75}_{33}\text{As}(n, \gamma)$	s pr
2.0%	4.57	2.3% 6.02
0.7%	5.21	1.2% 6.23
2.1%	5.59	0.9% 6.41
1.4%	5.80	

Also graph $E_\gamma = 3.5$ to 10.6

See also ^{77}Se and ^{78}Se

†Photons per 100 n captures

S.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).

$^{73}_{34}\text{Se}$ τ 44^m Ge(52-Mev α) chem
 $^{73}_{34}\text{Se}$ β^+ 1.7 a
 $^{73}_{34}\text{Se}$ Not D ^{52}As ($< 0.1\%$)
 $\sigma(^{73}\text{Se})/\sigma(^{44}\text{Se}) \sim 5$ $E_\alpha = 33$ to 52

F.H.Hooge, A.H.W.Aten, Jr., Physica 19, 1047 (1953).

$^{75}_{34}\text{Se}$ I 5/2 OCS^{75}Se M
 $^{75}_{34}\text{Se}$ q +0.9

L.C.Aamodt, P.C.Fletcher, G.Slivey, C.H.Townes, Phys. Rev. 94, 789A (1954).

Se⁷⁵
34 41
127^d
 γ ~1† (0.067) ~0.2† (0.203) scin
~4† (0.098) 100† { (0.269)
(0.124) { (0.281)
84† { (0.138) 17† (0.405)
(0.067†) (0.138†, 0.203†) { (0.124†) (0.281†)
(0.138†) (0.269†) No (0.405†) (γ)
A.W.Schardt, J.P.Welker, Phys. Rev. 93, 916A,
910 (1954).

Se⁷⁷
34 43
stable
I 1/2 (Se⁷⁷)₂ B
S.P.Davis, Phys. Rev. 93, 159 (1954).

γ Se⁷⁷ ($\alpha, \alpha\gamma$) $E_\alpha = 3.0$ scin
0.237

G.M.Temmer, N.P.Haydenburg, Phys. Rev. 93, 351
(1954); priv. comm.

Capture γ 's Se (n, γ) s pr
3.0† 6.586
0.3† 6.88 ?
1.8† 7.185
2.2† 7.416

Above γ 's fit Se⁷⁷ levels known from
Br⁷⁷ decay. See also Se
†Photons per 100 n captures in Se

G.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31,
1051 (1953).

Se⁷⁸
34 44
stable
I 0 (Se⁷⁸)₂ B
S.P.Davis, Phys. Rev. 93, 159 (1954).

Capture γ 's Se (n, γ) s pr
0.7† 7.73 0.7† 9.172
0.1† 7.95 1.0† 9.882
0.5† 8.092 0.08† 10.483
0.2† 8.50

>7.3 γ 's assigned to Se⁷⁸ from intensities
and known mass ratio

†Photons per 100 n captures in Se

G.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31,
1051 (1953).

Se⁷⁹
34 45
6.5x10⁴
I 7/2 Mic
 μ -1.015
Q 0.7

W.A.Hardy, G.Silvey, C.H.Townes, B.F.Burke,
M.W.P.Strandberg, G.W.Parker, V.W.Cohen, Phys.
Rev. 92, 1532 (1953); 85, 494 (1952).

Se⁸⁰
34 46
stable
I 0 (Se⁸⁰)₂ B
S.P.Davis, Phys. Rev. 93, 159 (1954).

Br γ Br ($\alpha, \alpha\gamma$) $E_\alpha = 3.0$ scin
0.044
0.213
0.266

N.P.Haydenburg, G.M.Temmer, Phys. Rev. 93, 906
(1954).

Br⁷⁴
35 39
36^m
 τ 36^m Cu⁶⁵ (90-Mev γ) chem
Mass assignment based on yields in Cu⁶⁵ (C, xn)
and Cu⁶³ (C, xn) reactions not p 7.1^bSe⁷³

J.W.Hollander, Phys. Rev. 92, 916 (1953).

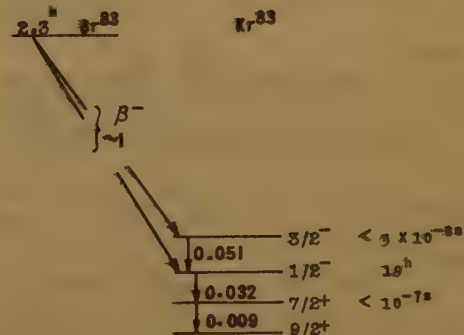
Br⁸⁰
35 45
18.5^m
 β^- ~15† (1.42) Br (slow n) chem; sl
85† 2.04^{*}
 β^+ 4† 0.862
 γ 12† 0.62 scin

L.Lidofsky, R.Gold, C.S.Wu, Phys. Rev. 94, 780A
(1954); * verbal report.

γ 0.62 Br⁷⁹ (pile n) scin

J.Laberrigue-Frolow, M.Langevin, R.Bernas,
Compt. rend. 238, 677 (1954).

Br⁸³
35 48
2.3^h
 τ 2.30^h 5 Se (10-Mev d) chem
 γ 0.051 K/L > 8 M1 $\alpha\beta^-$
 $\tau < 5 \times 10^{-8}$ s $\beta\gamma$
 $e^-/\beta = 0.12$ cc



P.Swinbank, J.Walker, Proc. Phys. Soc. 66A,
1093 (1953).

Kr⁷⁶
36 40
9.7^h
 τ 9.7^h γ^{89} (150-Mev p) chem
No β^+ with $E_{\beta^+} > 0.6$ p 17^bBr s
No x ray pc

A.A.Caretto, Jr., E.O.Willg, Phys. Rev. 93, 175
(1954).

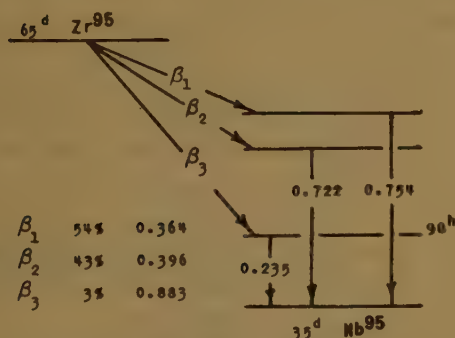
Kr⁷⁹
36 43
34.5^h
 γ (0.044) $\tau < 3^{+2}$ s $e_A \alpha e^-$ pc
(ce⁻ 0.044 γ) / (e_A (K)) ~ 0.007
 e_A (L) / e_A (K) = 1.66
 $e_L/e_K = 0.10$ or 0.25 (0.10 theory) for
fluorescence yield 0.63 or 0.57⁺⁺ resp.

M.Langevin, P.Radanyi, Compt. rend. 238, 77,
232 (1954); *Broyles, Thomas, Haynes, Phys.
Rev. 89, 723 (1953); *Esurhop, The Auger Effect,
Camb. Univ. Press p. 48 (1952).

Zr⁸⁸ τ **85^d** Nb(100-Mev p) chem
 40 48 Counted growth and decay of 106^d Y⁸⁸ 1.86 γ
 85^d 0.26 to 2.9 years after bombardment
 E.K.Hyde, Phys. Rev. 92, 927 (1953).

Zr⁹¹ μ **-1.3** **5**
 40 51 stable S.Suwa, J. Phys. Soc. Japan 8, 734(1953).

Zr⁹⁵ β^- 54% **0.364** **57 $\sqrt{2}$**
 40 55 43% **0.396**
 65^d 3% **(0.883)**
 γ **0.722** $a_K = 0.0014$ **57 $\sqrt{2}$ ce⁻**
0.754 $a_K = 0.0011$
 No $\beta\gamma(\theta)$



P.S.Mittelman, Phys. Rev. 94, 99(1954); 91, 484A (1953).

Nb^{92?} τ **13^h** Nb⁹³ (14-Mev p) chem
 41 51 γ **2.35** scin
 13^h α K α ray a
 No β^+ scin
 Not p 10^d Nb
 $\sigma(10^d \text{ Nb})/\sigma(13^h \text{ Nb}) \sim 10$ for $E_p = 14$ to 20
 R.A.James, Phys. Rev. 93, 288 (1954).

Nb⁹³ Nb⁹³ ($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$
 41 52 No γ scin
 41 52 stable G.M.Temmer, H.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Nb⁹⁴ Capture γ 's Nb⁹³ (n, γ) s pr
 41 53 0.8 \dagger 5.90
 2.7 $\times 10^4$ 0.8 \dagger 6.85
 0.4 \dagger 7.19
 Also graph $E_\gamma = 2.5$ to 7.7
 $E_n(\text{Nb}^{93}) = 7.3$ from Nb⁹³ (d, p)
 \dagger Photons per 100 n captures

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31, 1025(1953).

Nb⁹⁵ γ **0.220** K/LM=4.3 s ce⁻
 41 54 96^h V.M.Dorishmyuk, G.M.Drabkin, V.I.Orlov, L.I.Rusinov, Doklady Akad. Nauk SSSR 92, 1141 (1953); NSF-tr-229

Nb⁹⁵ γ **(0.77)** K/LM=2.4 sl ce⁻
 41 54 35^d $\alpha = 0.0021$
 E.F.Sturcken, Z.O.Fröel, A.H.Weber, Phys. Rev. 93, 1053 (1954).

Mo Mo($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$
 γ **0.198** scin
 G.M.Temmer, H.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Capture γ 's	Mo (n, γ)	s pr
0.7 \dagger	6.39 0.2 \dagger 7.66	
1.1 \dagger	6.66 0.1 \dagger 7.79	
3.1 \dagger	6.92 0.5 \dagger 8.39*	
0.3 \dagger	7.40 0.03 \dagger 9.15	
0.7 \dagger	7.54*	

Also graph $E_\gamma = 2.7$ to 9.2
 *Fit with known Mo⁹⁶ levels if 9.15 γ is Mo⁹⁶ g.s. transition
 \dagger Photons per 100 n captures

E.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051(1953).

Mo⁹³ (0.26 γ) (0.69 γ) (θ) (0.26 γ) (1.48 γ) (θ)
 42 51 (0.69 γ) (1.48 γ) (θ)
 6.9 I = 23/2, 15/2, 11/2, 7/2

J.J.Kreushaar, Phys. Rev. 92, 318 (1953).

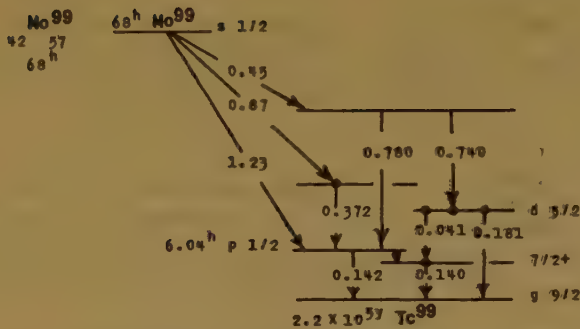
Mo⁹⁵ I **5/2** Mo⁹⁵ 8
 42 53 μ negative
 stable $\mu(\text{Mo}^{97})/\mu(\text{Mo}^{95}) = 1.022$
 E.C.Woodward, Jr., Phys. Rev. 93, 954A(1954).

Mo⁹⁷ I **5/2** Mo⁹⁷ 8
 42 53 μ negative
 stable $\mu(\text{Mo}^{97})/\mu(\text{Mo}^{95}) = 1.022$
 E.C.Woodward, Jr., Phys. Rev. 93, 954A (1954).

Mo⁹⁸ β^- 14% (0.45) $\beta\gamma$ scin
 42 57 $\sim 1\%$ 0.87 Mo(slow n)
 66^h 85% (1.23)
 γ 0.041 $\alpha \sim 5$ 0.372 scin
 0.140 0.740
 0.181 (0.780)

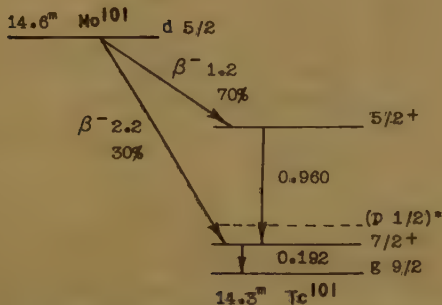
(0.87 β) (0.372 γ) No (1.23 β) γ
 (0.740 γ) (0.041 γ , 0.140 γ , 0.181 γ)
 (0.041 γ) (0.140 γ) No (0.372 γ) γ
 No (0.780 γ) (0.041 γ , 0.140 γ , 0.181 γ)

J.Varma, G.E.Mandeville, Phys. Rev. 94, 91, 780A(1954); J.Franklin Inst. 256, 573(1953).



J.Varma, C.E.Mandeville, Phys. Rev. 94, 91
780A(1954); J.Franklin Inst. 256, 373(1953).

Mo ¹⁰¹	τ	14.6 ^m	Mo ¹⁰⁰ (15-Mev d)	
42 59	β^-	70%	1.2	a
14.6 ^m		30%	2.2	
	γ		0.20	scin
			0.96	



"Lack of Tc¹⁰¹ isomer implies p 1/2 above 7/2⁺
See also Tc¹⁰¹.

D.R.Wiles, Phys. Rev. 93, 181 (1954).

Tc ⁹³	0.39y assigned to 43.5 ^m Tc ⁹³	ms
43 50		
43.5 ^m	R.Gernas, J.Beyden, L.Papineau, Compt. rend. 238, 791 (1954).	

Tc ⁹⁸	~42 ^m activity not assignable to Tc ⁹⁸	
43 59	Mo ⁹⁸ (7.4-Mev d) Mo ⁹⁵ (80-Mev d)	
?	J.K.Lerchl, W.L.Pool, D.W.Kundu, R.A.House, Phys. Rev. 92, 934(1953).	

Tc ⁹⁹	I	9/2	B
43 56	μ	5.5	
2.2x10 ^{5y}	q	+0.3	

K.G.Kessler, R.E.Trues, Phys. Rev. 92, 303,
(1953).

Tc ¹⁰¹	τ	14.3 ^m	Mo ¹⁰⁰ (15-Mev d)	chem
43 58	β^-	1.4		a
14.3 ^m	γ	0.30		scin

No isomer with $\tau > 3^m$ or $< 2^d$ found from decay
of 14.6^mMo. All long-lived Tc found
ascribed to 60^dTc⁹⁵ and 90^dTc⁹⁷.

D.R.Wiles, Phys. Rev. 93, 181 (1954).

Ru	Relative abundances	C ₁₀ H ₁₀ Ru	ms
	$\frac{x}{A}$	$\frac{x}{A}$	
	5.50	96	17.01 101
	1.91	98	31.52 102
	12.70	99	18.67 104
	12.69	100	

L.Friedman, A.P.Irae, J. Am. Chem. Soc. 75,
5741 (1953).

Ru(α, γ)	E _{α} = 3.0	
γ	0.091	scin
	0.128	
	0.260	

M.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906
(1954).

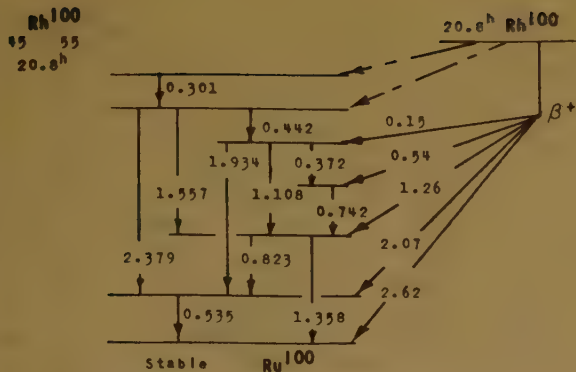
Resonances	Ru(n)	E _n (ev)	$\sigma_0 \Gamma^2$	E _n = 1 to 1000ev time of flight
		9.8	16	
		15.2	14	
		24.1	18.0	
		40.9	32.0	

E.Melkonian, W.W.Havens, Jr., L.J.Rainwater,
Phys. Rev. 92, 702 (1953).

Rh ^{98?}	τ	9 ^m	d 15 ^m Pd	chem
45 53	β^+	4.0		a
9 ^m				

A.H.W.Aten, Jr., T. de Vries-Hamerling,
Physica 19, 1200 (1953).

Rh ¹⁰⁰	τ	20.8 ^h	d 4.0 ^d Pd	sl
45 53	β^+	0.064	0.15	
20.8 ^h		3.8	0.54	
		18	1.26	
		39	2.07	
		45	2.62	F-K probably linear
γ	5.3	0.301	1.5	1.108
	0.9	0.372	2.8	1.358
	21.8	0.442	1.1	1.557
	100.0	0.535	0.4	1.934
	0.6	0.742	1.0	2.379
	9.7	0.823		*Rel. intensity co ⁻
		(co ⁻ 0.585) / β^+ = 0.062		$\beta^+/\epsilon = 0.05$ (est.)



L. Marquez, Phys. Rev. 92, 1511 (1953).

Rh ¹⁰³	Rh ¹⁰³ (α, γ)	$E_\alpha = 3.0$	
45 58 stable	γ	0.305	scin
		0.370	

G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

Rh ¹⁰⁴	γ	(0.051) $\alpha_K = 1.9$	scin
45 59 4.3m			

E. Germagnoli, A. Malvicini, L. Zappa, Nuovo Cim. 10, 1388 (1953).

Rh ¹⁰⁴	γ	0.552	scin
45 59 4.4s			

No other γ with $E_\gamma > 0.2$

E. Germagnoli, A. Malvicini, L. Zappa, Nuovo Cim. 10, 1388 (1953).

Capture γ 's	Rh ¹⁰³ (n)	s	pr
0.5†	5.55	0.7†	6.20
0.5†	5.91	0.2†	6.36
0.6†	6.06	0.2†	6.79

Also graph $E_\gamma = 3$ to 7.2

E_n (Rh¹⁰³) = 6.8 from Rh¹⁰³ (d, p)

†Photons per 100 n captures

G.A. Bartholomew, B.B. Kinsey, Can. J. Phys. 31, 1025 (1953).

Resonance	Rh ¹⁰³ (n, γ)	
	1.26 eV $\sigma_0 \approx 4850$	cryst s

M.H. Landon, Phys. Rev. 93, 931A (1954).

Resonance	Rh ¹⁰³ (n)	J = 1
	(1.26) eV	
	$\Gamma_n / \Gamma = 0.004 \pm 0.003$	

B.N. Brockhouse, Can. J. Phys. 31, 432 (1953).

Rh ¹⁰⁵	β^-	4% ~ 0.21	Ru (pile n) chem
45 60 36.5h		96% (0.57)	$\alpha \beta \gamma$
	γ	0.32	scin
		($\sim 0.21 \beta$) (0.32 γ)	

C. Levi, L. Papineau, Compt. rend. 238, 1407 (1954).

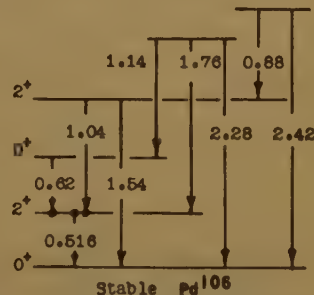
Rh ¹⁰⁶	(0.624 γ) (0.513 γ) (θ)	I = 0, 2, 0	scin
45 61	(1.045 γ) (0.513 γ) (θ)	I = 2, 2, 0	
30s	$\gamma\gamma$ (θ) coefficients differ by 3% from theory		
	No (0.870 γ) (1.045 γ)		

E.D. Kiema, F.K. McGowan, Phys. Rev. 92, 1469, (1953).

γ	20.5†	0.516	d 1.0 γ Ru	scin
	10.4†	0.619	0.2†	1.54
	0.3†	0.88	< 0.1†	1.76
	1.7†	1.04	< 0.1†	2.28
	0.4†	1.14	< 0.1†	2.42

†Photons per 100 disintegrations

30^s Rh¹⁰⁶



B. Kahn, W.S. Lyon, Phys. Rev. 92, 902 (1953).

Fd	Resonances	Pd (n)	$E_n = 1$ to 50 eV
	w	13.3 eV	cryst s
	w	26 eV	
	st	34.1 eV (Pd ¹⁰⁹ ?)	

M.H. Landon, V.L. Sailor, Phys. Rev. 93, 1030 (1954).

Pd ^{98?}	τ	15m	Ru (52-MeV α) chem
46 52 15m			p 9m Rh chem

A.H.W. Aten, Jr., T. de Vries-Hamerling, Physica 19, 1200 (1953).

Pd ¹⁰⁰	γ	0.0807	sl co-
46 54 4.0d			

In 4^d activity with 21^h Rh from Ag (420-MeV p)

L. Marquez, Phys. Rev. 92, 1511 (1953).

Pd^{103} γ (0.040) $K/LM = 0.18$ pc Ag^{105}
 46 57 $\alpha_K = 70$ 47 58
 17^d $E_\epsilon = 0.036$ from $\epsilon_K/\epsilon_L = 1.5$ 45^d
 $E_{dis} = 0.036 + 0.040$ (E_γ)
 P. Avignon, J. Phys. Radium 14, 637 (1953).

Rh^{103} (20-Mev d) chem
 γ $4\uparrow$ 0.26 \uparrow scin
 $11\uparrow$ 0.305
 $60\uparrow$ 0.367
 $11\uparrow$ 0.503
 $E_{dis} = 0.53 \pm 0.040$ (E_γ) scin
 from continuous γ endpoint
 \uparrow Photons per 10^4 disintegrations

L.H.Th. Rietjens, H.J. Van den Bold, P.M. Endt, Physica 20, 107 (1954).

$\text{Pd}^{105?}$ $\text{Pd}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$ scin
 46 59 γ 0.068 \uparrow
 stable
 G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

Pd^{113} τ 1.5^m D 6.5^h Ag chem
 46 67 U(190-Mev d) chem
 1.5^m
 H.G. Nicks, R.S. Gilbert, Phys. Rev. 94, 371 (1954)

Ag Capture γ 's Ag(n, γ) s pr
 $1.1\uparrow$ 6.06 0.1 \uparrow 6.95
 $0.4\uparrow$ 6.27 0.3 \uparrow 7.06
 $0.4\uparrow$ 6.55 0.4 \uparrow 7.27
 $0.2\uparrow$ 6.67

Also graph $E_\gamma = 3$ to 7.4

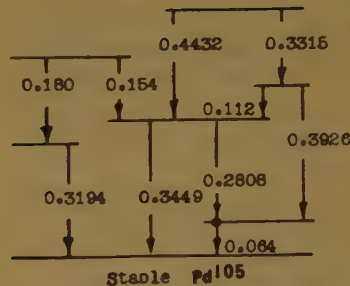
$E_n(\text{Ag}^{107?}) = 7.0$ from Ag(d, p)

\uparrow Photons per 100 n captures

G.A. Bartholomew, B.B. Kinsey, Can. J. Phys. 31, 1025 (1953).

γ Ag($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$ scin
 0.321
 0.430

Ag^{105} γ 0.0640 d 54.7^m Cd
 47 58 0.2808 $K/L_1 \geq 5$ $\text{Ag}(\text{pile n})$ dpl
 45^d 0.3194
 0.3315
 0.3449 $K/L_1 \geq 5$
 0.3926
 0.4432



F.A. Johnson, Can. J. Phys. 31, 1136 (1953).

Ag^{107} γ 0.0930 d 6.7^h Cd $\text{Ag} \text{ Ce}^-$
 47 60 $L_1 : L_2 : L_3 = 0.2 : 1 : 1$
 44^s
 F.A. Johnson, Can. J. Phys. 31, 1136 (1953).

γ (0.094) $\alpha_K = 9.5$ E3 d 6.7^h Cd
 $K/LM = 0.88$ scin, sl Ce^-
 J. Brunner, O. Huber, R. Joly, D. Maeder, Helv. Phys. Acta 26, 588A (1953).

Ag^{107} μ -0.11305 AgNO_3 1
 47 60 $\nu(\text{Ag}^{107})/\nu(\text{Ag}^{109}) = 0.86985$ 1
 stable $\nu(\text{Ag}^{109})/\nu(\text{D}) = 0.30316$ 3
 P.B. Sogo, C.D. Jeffries, Phys. Rev. 93, 174 (1954).

μ -0.113014 AgNO_3 1
 $\nu(\text{Ag}^{107})/\nu(\text{H}) = 0.040468$ 1
 E. Brun, J. Oeser, H.H. Staub, C.G. Telachow, Phys. Rev. 93, 172 (1954).

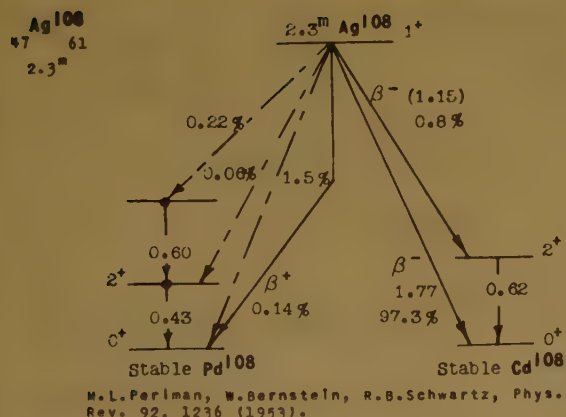
$\text{Ag}^{107}(\alpha, \alpha'\gamma)$ $E_\alpha = 3.0$ scin
 0.333
 0.442

G.M. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954); priv. comm.

Ag^{108} β^- (0.8%) (1.15) Ag(pile n) scin
 47 61 97.3% 1.77
 2.3^m γ 100 \uparrow 0.43 scin
 79 \uparrow 0.60
 0.62

No 1.03y No 0.19y
 $(K \text{ x ray}) (0.43y, 0.60y) (0.60y) (0.43y)$
 No β^+ γ
 $\epsilon_K/\beta^- = 0.016$
 15% ϵ to excited levels.
 $\beta^+/\beta^- = 0.0014$

pc
 xy/x



Ag¹⁰⁹ γ 0.0879 d 470^dCd β^- ce⁻
47 62
40^s F.A.Johnson, Can. J. Phys. 31,1136(1953).

γ 0.087 $\alpha_K \sim 8.6$ E3 d 13^h Pd; pc
P. Avignon, J. phys. radium 14, 636 (1953).

γ (0.087) $a_K = 12.4$ E3 d 470^d Cd
K/LH = 0.85 scin, slce⁻

J. Brunner, O. Huber, R. Joly, D. Maeder, *Helv. Phys. Acta* 26, 588A (1953).

Ag^{109} μ -0.12996 AgNO_3
 $47 \quad 62$ $\nu(\text{Ag}^{109})/\nu(\text{D}) = 0.303163$
 stable
 P.B.Sogo, C.D.Jeffries, Phys. Rev. 93, 174
 (1954).

$$\mu \quad -0.129923 \quad \text{AgNO}_3 \quad 1$$

$$\nu(\text{Ag}^{109})/\nu(\text{H}) = 0.046523 \quad 1$$

E. Brun, J. Oeser, H. H. Staub, C. G. Telschow;
Phys. Rev. 93, 172 (1954).

$^{110}_{47}\text{Ag}$	β^-	107†	0.080	sl
$^{63}_{27}\text{Co}$		32†	0.314	
$^{270}_{108}\text{Pt}$		153†	0.530	

T. Azuma, Phys. Rev. 94, 638 (1954).

^{105}Cd	τ	54.7 ^m	$\Delta E(20\text{-MeV D})$		chem
48 57	β^+	0.80			sl
54.7 ^m		1.691			
	γ	0.0255	$I_2 I_3 / I_{\text{IN}} = 4$		$I_2 \ll I_3$
		0.0277			577 ce^-
		0.2630	0.3249	1.908	
		0.2925	0.3363	1.96	
		0.3080 ^a	0.3407	2.00	
		0.3121	0.3470 ^a	2.045	
		0.3171	0.4331 ^a	2.277	
		0.3205 ^a	0.6067	2.32	

No $\beta^+\gamma$ for $E_\gamma > 0.5$

*Most intense lines

F.A. Johnson, Can. J. Phys. 31, 1136 (1953);
Proc. Roy. Soc. Canada, 46, 135A (1952).

$\text{Cd}^{107} \beta + / 0.85 \gamma = 0.66 \pm 0.05$ scin
48 59
6.7^h D. Maeder, R. Müller, V. Wintersteiger, Helv.
Phys. Acta 27, 3 (1954).

$^{109}_{48}\text{Cd}$ $E_{\epsilon} = 0.07$ from $\epsilon/\epsilon_K = 0.28 \pm 3$ 497 scin
 $^{61}_{47}\text{Ga}$ $E_{d1a} = 0.07 + 0.087 (E_{\gamma})$
 $^{70}_{47}\text{Ga}$
 E. der Mateosian, Phys. Rev. 92, 938 (1953);
 87. 193A (1952).

$\text{Cd III } \gamma$ (0.15) E3 > 99.7% $\gamma\gamma(\theta)$
 48.63 (0.15 γ) (0.25 γ) (θ) I = 11/2, 5/2, 1/2
 48.7^m Molten Cd metal

J.J.Kraushaar, R.V.Pound, Phys. Rev. 92,523,
(1953).

Cd^{114}	Capture γ 's	$\text{Cd}(n,\gamma)$	s pr
$48 \quad 66$	$2.2 \uparrow$	$5.94 \quad 0.12\uparrow$	7.84
stable	$0.36\uparrow$	$6.82 \quad 0.23\uparrow$	8.483
	$0.21\uparrow$	$7.67 \quad 0.14\uparrow$	9.046
	$0.16\uparrow$	7.73	

Also graph $E_\gamma = 2.8$ to 9.5
 $B_n(\text{Cd}^{113}) \sim 9$ from mass measurements
 †Photons per 100 n captures in Cd

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051(1953); Phys. Rev. 90, 355A(1953).

$^{117}_{48}\text{Cd}$	γ	0.267	1.27	sm ce ⁻
69		0.281	1.55	scin
3.0 ^h		0.331*	2.00	
		0.43		
		0.84		^{116}Cd (pile n)

J.M. LeBlanc, J.M. Cork, S.B. Burson, Phys. Rev. 93, 916A (1954); * verbal report.

Cd $\text{Cd}(\alpha, \alpha', \gamma)$ $E_a = 3.0$
 γ 0.300? scin
 G.W.Tanner, M.P.Haydenburg, Phys. Rev. 93, 351
 (1954).

	$\ln(D, D^*\gamma)$	$E_p = 3.0$	
γ	0.500		scin

G.M. Tommer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

$^{114}_{49}\text{In}$ β^+ 0.004% ~ 1.2 a
 $^{114}_{65}\text{In}$ γ (0.722) M1 96% E2 4% $\gamma\gamma(\theta)$
 $^{114}_{72}\text{In}$ (0.72 γ)(0.56 γ)(θ) I = 2, 2, 0
 No low energy β^- (<0.1%) $\alpha\beta\gamma$

M.W.Johns, C.C.McMullen, R.J.Donnelly, S.V.
 Hable, Can. J. Phys. 32, 35 (1954).

γ 100† (0.556) scin
 80† (0.722)
 4† (1.271)

D.Maeder, R.Müller, V.Wintersteiger, Helv.
 Phys. Acta 27, 3 (1954).

γ (0.722) M1 97% E2 3% $\gamma\gamma(\theta)$
 (0.72 γ)(0.56 γ)(θ) I = 2, 2, 0

D.G.Aikhazov, I. Kh. Lemberg, A.P.Grinberg,
 Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 487
 (1953); Chem. Abstr. 48-2488a (1954).

$^{115}_{49}\text{In}$ In(n,n')4.5 h In E_n = 0.4 to 1.8
 $^{115}_{66}\text{In}$ Levels* 0.60? scin
 $^{115}_{67}\text{In}$ 0.85
 1.37
 1.75?

*Sharp increases in slope of σ curve

A.A.Ebel, C.Goodman, Phys. Rev. 93, 197 (1954).

In(n,n')4.5 h In E_n = 0.4 to 5.5
 Threshold 0.4 scin
 Levels* ~ 1
 ~ 1.35

*Flat sections of σ curve

H.C.Martin, B.C.Diven, R.F.Taschek, Phys. Rev.
 93, 199 (1954); 92, 1096A (1953).

Levels In(n,n γ) E_n = 2.5
 0.61*
 0.92*
 γ 0.25 scin
 0.34
 0.44
 0.75 ?
 0.87

*Inelastic neutrons detected

E.A.Elliott, D.Hicks, L.E.Beghian, H.Halban,
 Phys. Rev. 94, 144 (1954).

$^{116}_{49}\text{In}$ τ_2 $^{116}_{67}\text{In}$ β^- $^{116}_{13}\text{Sn}$ Sn(14-Mev n) a
 $^{116}_{13}\text{Sn}$ ~ 2.8

Z.Wilhelmi, R.Brunez, C.Dabrowski, Bull. Acad
 Polon. Sci. 1, 103 (1953).

$^{116}_{49}\text{In}$ Capture γ 's In(n, γ) s pr
 $^{116}_{67}\text{In}$ 1.1† 4.97 0.4† 5.55
 $^{116}_{13}\text{Sn}$ 1.0† 5.17 0.3† 5.73
 0.8† 5.34 0.7† 5.86

Also graph E_γ = 3 to 8.2

E_n (In 115) = 6.6 from In(d,p)

†Photons per 100 n captures in In

G.A.Bartholomew, B.B.Kinsey, Can. J. Phys. 31,
 1025 (1953).

Resonance In(n)
 (1.45)ev J = 4
 $\Gamma_n/\Gamma = 0.043 \pm 0.006$

B.N.Brockhouse, Can. J. Phys. 31, 432 (1953).

$^{117}_{49}\text{In}$ τ_1 2.3 h
 $^{117}_{68}\text{In}$ γ 0.160 srt ce $^-$
 $^{117}_{19}\text{In}$ IT 0.312 scin
 0.562*
 0.725*

No β (0.312 γ)

J.M.LaBlanc, J.M.Cork, S.B.Burson, Phys. Rev.
 93, 916A (1954); * verbal report.

τ_1 1.90 h d 50 m Cd chem
 β^- 30% 1.616 sl ce $^-$
 70% 1.772
 γ 0.161 α_K = 0.13 M1 sl ce $^-$,
 0.311 α_K = 1.3 M4 scin

(β)(0.16 γ) No (0.31 γ)(β , γ)

p 1.1 h In 28% Not d 3.0 h Cd (<10%)

C.L.McGinnis, Phys. Rev. 94, 780A (1954);
 verbal report.

$^{117}_{49}\text{In}$ τ_2 1.1 h d 3.0 h Cd chem
 $^{117}_{68}\text{In}$ β^- 0.740 sl
 $^{117}_{19}\text{In}$ γ 86† 0.161 α_K = 0.13 scin, sl ce $^-$
 100† 0.565 α_K \sim 0.005

(β)(0.16 γ , 0.57 γ) (0.16 γ)(0.57 γ)

No 0.726 γ (<1†)

d 1.6 h In 28% Not d 14 d Sn (<1%)

C.L.McGinnis, Phys. Rev. 94, 780A (1954);
 verbal report.

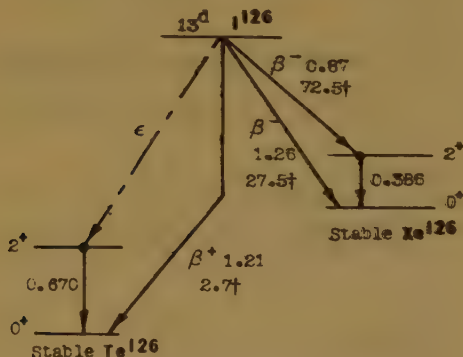
$^{118}_{49}\text{In}$ τ_1 4.5 m Sn(14-Mev n)
 $^{118}_{69}\text{In}$ 4.5 m Z.Wilhelmi, R.Brunez, C.Dabrowski, Bull. Acad
 Polon. Sci. 1, 103 (1953).

No γ Sn(α , $\alpha'\gamma$) E_α = 3.0 scin

M.P.Haydenburg, G.W.Temmer, Phys. Rev. 93, 906
 (1954).

Sn	Capture γ 's	Sn(n, γ)	s pr	Sb ¹²⁴ 51 73 60 ^d	β^-	0.360 0.582 0.745	0.925 1.585 2.295	s
	0.4†	9.35						
	Also graph $E_\gamma = 3$ to 9.5							
	†Photons per 100 n captures							
	B.S.Kinsey, G.A.Bartholomew, Can. J. Phys. 31, 1051 (1953).							
Sb		Sb(α,γ)	$E_\alpha = 3.0$	scin	γ	0.607 0.658 0.713	0.840 1.720 2.03	s pe ⁻
	γ	0.16						
	G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).							
	Capture γ 's	Sb(n, γ)	s pr					
	0.6†	5.43	1.1†	6.33				
	1†	5.61	1.6†	6.50				
	1†	5.89	0.7†	6.90				
	1†	6.11						
	Also graph $E_\gamma = 3$ to 8							
	E_n (Sb ¹²¹) = 6.6 from Sb(d,D)							
	†Photons per 100 n captures							
	G.A.Bartholomew, B.S.Kinsey, Can. J. Phys. 31, 1025 (1953).							
Sb ¹²¹ 51 70 stable	q	-0.5	Sb ¹²¹	8	Te	Te(α,γ)	$E_\alpha = 3.0$	scin
	K.Murakawa, Phys. Rev. 93, 1232 (1954).							
	q	-1.3		8	No γ			
	Based on $q(\text{Sb}^{123})/q(\text{Sb}^{121}) = 1.26^a$							
	G.Sprague, D.H.Tomboulian, Phys. Rev. 92, 105 (1953); 91, 476A(1953); *H.G.Dehmelt, H.Kruger Z.Physik 130, 385 (1951).							
Sb ¹²² 51 71 2.75 ^d	τ	2.75 ^d	Sb ¹²¹ (pile n)		Te ¹²¹ 52 69 154 ^d	γ	(0.213) E2 5.8% (ce _K ⁻ 0.082 γ)(0.213 γ)(θ)	
	β^-	6† ~0.45 56† 1.40 36† 2.00	F-K plot not linear $\Delta I = 2$, yes shape	ST/2				
	No β^+							
	γ	0.095 0.553	K/L ~1	0.694				
	s	0.566	K/L = 7	1.10				
		0.616		1.27				
	w	0.647		1.97				
	x	K x ray						
	(0.566 γ) (1.4 β , 0.694 γ)							
	J.M.Cork, M.K.Brice, G.D.Hickman, L.C.Schmid, Phys. Rev. 93, 1059 (1954).							
Sb ¹²³ 51 72 stable	q	-0.7	Sb ¹²³	8	Te ¹²² 52 71 104 ^d	γ	0.159 $a_K = 0.19$ M1	scin
	K.Murakawa, Phys. Rev. 93, 1232 (1954).							
	q	-1.7		8				
	G.Sprague, D.H.Tomboulian, Phys. Rev. 92, 105 (1953); 91, 476A(1953).							
	Capture γ 's	Sb(n, γ)	s pr					
	0.6†	5.43	1.1†	6.33				
	1†	5.61	1.6†	6.50				
	1†	5.89	0.7†	6.90				
	1†	6.11						
	Also graph $E_\gamma = 3$ to 8							
	E_n (Sb ¹²¹) = 6.6 from Sb(d,D)							
	†Photons per 100 n captures							
	G.A.Bartholomew, B.S.Kinsey, Can. J. Phys. 31, 1025 (1953).							
Sb ¹²³ 51 72 stable	q	-0.7	Sb ¹²³	8	Te ¹²³ 52 71 104 ^d	γ	(0.159) E2 1.2% (ce _K ⁻ 0.089 γ)(0.159 γ)(θ)	
	K.Murakawa, Phys. Rev. 93, 1232 (1954).							
	q	-1.7		8				
	G.Sprague, D.H.Tomboulian, Phys. Rev. 92, 105 (1953); 91, 476A(1953).							
	Capture γ 's	Sb(n, γ)	s pr					
	0.6†	5.43	1.1†	6.33				
	1†	5.61	1.6†	6.50				
	1†	5.89	0.7†	6.90				
	1†	6.11						
	Also graph $E_\gamma = 3$ to 8							
	E_n (Sb ¹²¹) = 6.6 from Sb(d,D)							
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	Capture γ 's	Sb(n, γ)	s pr					
	0.6†	5.43	1.1†	6.33				
	1†	5.61	1.6†	6.50				

$^{126}_{53}\text{Te}$	β^-	72.5†	0.87	$I(28\text{-Mev d})$ chem; sl
$^{126}_{53}\text{Te}$	β^+	27.5†	1.26	
$^{126}_{53}\text{Te}$	γ	2.7†	1.21	
				sl $\text{ce}^- \text{pe}^-$; scin
			0.386	$\alpha_K = 0.016 \quad K/LM \geq 8$
			0.670	

No 0.54 β^+ (<1.3†)(0.87 β) (0.38 γ) (K X ray) (0.67 γ) $\epsilon_K/(0.67\gamma) = 1.35 \quad (0.67\gamma)/(0.38\gamma) = 1.0$ 

N. Marty, H. Langevin, P. Hubert, J. Phys.-radium 14,663 (1953); Compt. rend. 236,1153 (1953).

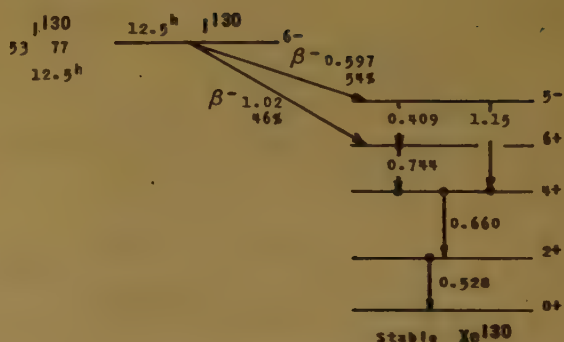
$^{127}_{53}\text{Te}$	γ	$I^{127}(\alpha, \alpha', \gamma)$	$E_\alpha = 3.0$	scin
		0.057		
		0.205		

N. P. Heydenburg, G. M. Temmer, Phys. Rev. 93,906 (1954).

Q	-0.819	M
		V. Jaccarino, J. G. King, H. H. Stroke, quoted by R. Livingston, et al Phys. Rev. 92,1271 (1953).

$^{128}_{53}\text{Te}$	γ	0.436	scin
			E. Gernagnoli, A. Malvicini, L. Zappa, Nuovo Cim. 10, 1388 (1953).

$^{130}_{53}\text{Te}$	β^-	54% 0.597	Te^{130} (11-Mev d) chem	sl
		46% 1.02		
	γ	30† 0.409	$\alpha_K (\times 10^3)$	K/LM
		100† 0.528	16	11
		90† 0.660	5.5	8 E2
		80† 0.744	3.2	16 E2
		40† 1.15	2.7	4 E2
			0.25	E1

(0.744 γ)(0.660 γ , 0.528 γ , 0.409 γ)
(1.15 γ)(0.660 γ , 0.528 γ)No β^- with $E_\beta > 1.02$ 

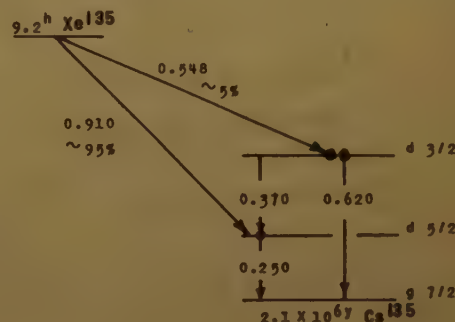
R. S. Caird, A. C. G. Mitchell, Phys. Rev. 94,412, 780A (1954).

$^{131}_{53}\text{Te}$	I	7/2	$\text{CH}_3\text{I}^{131}$	Mic
	Q	-0.412		
	Q (I^{131})/Q (I^{127})	= 0.5051		
	*Based on Q (I^{127})	= -0.819 (See I^{127})		
	R. Livingston, B. M. Benjamin, J. T. Cox, W. Gordy, Phys. Rev. 92, 1271 (1953).			

$^{129}_{54}\text{Xe}$	μ	-0.77254	Xe	I
	$\nu(\text{Xe}^{129})/\nu(\text{H})$	= 0.2708335		
	stable			
	E. Brun, J. Oesser, H. H. Staub, C. G. Teichow, Phys. Rev. 93, 904 (1954).			

$^{131}_{54}\text{Xe}$	μ	-0.68680	Xe	I
	$\nu(\text{Xe}^{131})/\nu(\text{H})$	= 0.0819781		
	stable			
	E. Brun, J. Oesser, H. H. Staub, C. G. Teichow, Phys. Rev. 93, 904 (1954).			

$^{135}_{54}\text{Xe}$	β^-	~ 5% 0.548	By sl
		~ 95% (0.910)	
	γ	0.250	scin
		0.37	
		0.60	
		(0.548 β) (0.60 γ)	
		(ce_K^- 0.25 γ) (0.37 γ) No (ce_K^- 0.25 γ) (0.60 γ)	



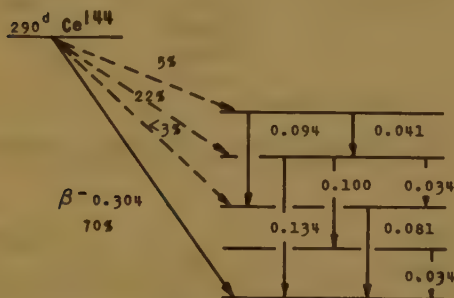
S. Thulin, Phys. Rev. 94, 734 (1954).

[illegible]

Ce?		Ce($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$	
γ		0.077		scin
		0.129		

N.P. Heydenburg, G.W. Temmer, Phys. Rev. 93, 906 (1954).

Ce^{144} 58 86 290 ^d	β^-	70%	0.304	U(n,f) chem; sl	
				K/L	L/H sl ce ⁻
	γ	16†	0.034	3	
		12†	0.041	11	
		3†	0.053		
		59†	0.081	5	0
		7†	0.094		ME
		5†	0.100		
		115†	0.134	8	≥ 4
					M1
					scin
					(0.134 γ)/(0.081 γ) ~ 15
					†Relative intensity ce ⁻



W.S. Emmerich, W.J. Auth, J.O. Kurbatov, Phys. Rev. 94, 110; 794A (1954).

$\text{Ce}^{145?}$ 58 87 3 ^m	τ	3.0 ^m	U(pile n) chem; p	6 ^h Pr
	β^-	~2.0		a
	γ 's			

S.S. Markowitz, W. Bernstein, S. Katcoff, Phys. Rev. 93, 178 (1954).

Ce^{146} 58 88 14 ^m	β^-	0.7	U(n,f) chem;	scin
	γ	W	0.05	scin
		20†	0.110	
		42†	0.142	
		50†	0.22	
		W	0.25	
		12†	0.27	
		100†	0.32	
			(0.06 γ)(0.27 γ) (0.110 γ)(0.22 γ , 0.25 γ)	
			(0.142 γ)(0.22 γ) No(0.32 γ)(γ)	
			β (all γ 's)	

W. Bernstein, S.S. Markowitz, S. Katcoff, Phys. Rev. 93, 1073 (1954).

Pr^{141} 59 82 stable		$\text{Pr}^{141}(\alpha, \alpha'\gamma)$	$E_\alpha = 3.0$	
	γ	0.15		scin

G.W. Temmer, N.P. Heydenburg, Phys. Rev. 93, 351 (1954).

Pr^{142} 59 83 19.2 ^h	Capture γ 's	$\text{Pr}^{141}(n, \gamma)$	s pr
	3†	4.69	3† 5.67
	2†	4.79	2† 5.83
	3†	5.16	

Also graph $E_\gamma = 2.5$ to 6.5
 $B_n(\text{Pr}^{141}) = 5.65$ from $\text{Pr}^{141}(d, p)^+$
†Photons per 100 n captures

G.A. Bartholomew, S.B. Kinsey, Can. J. Phys. 31, 1023 (1953); *N.S. Wall, priv. comm.

Pr^{144} 59 83 17.5 ^m	β^-	3%	0.8	d 290 ^d Ce	sl
		2%	2.3		
		95%	2.98		
	γ		0.060 ? K/L=1	37 ce ⁻ (Nd)	
			(0.695)		scin
			(1.480)		
			(2.185)		

No 0.060 photon scin

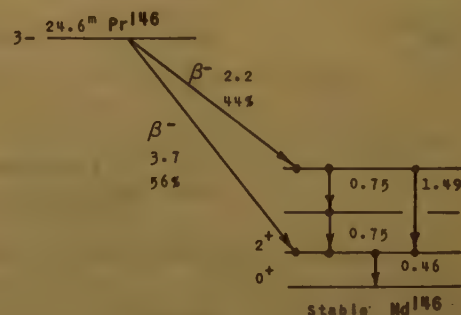
W.S. Emmerich, W.J. Auth, J.O. Kurbatov, Phys. Rev. 94, 110, 794A (1954).

$\text{Pr}^{145?}$ 59 86 6.0 ^h	τ	6.0 ^h	d 3 ^m fission Ce chem
	β^-	~1.7	

S.S. Markowitz, W. Bernstein, S. Katcoff, Phys. Rev. 93, 178 (1954).

Pr^{146} 59 87 24.6 ^m	β^-	44†	2.3	d 14 ^m Ce chem;	scin
		56†	3.7		
	γ	100†	0.46		scin
		W	0.59?		
		22†	0.75	(double)	
		33†	1.49		

(0.46 γ)(3.7 β^- , 0.75 γ , 1.49 γ)
(2.3 β^-)(0.75 γ , 1.49 γ) (0.75 γ)(0.75 γ)
No(0.59 γ)(γ) No(0.75 γ)(1.49 γ)



W. Bernstein, S.S. Markowitz, S. Katcoff, Phys. Rev. 93, 1073 (1954).

Nd		$\text{Nd}(\alpha, \alpha'\gamma)$	$E_\alpha = 3.0$	
γ		0.070		scin
		0.130		

N.P. Heydenburg, G.W. Temmer, Phys. Rev. 93, 906 (1954).

Nd^{143} $|\mu|$ 1.0 para
 60 83
 stable q ~ 1
 $\mu(\text{Nd}^{143})/\mu(\text{Nd}^{145}) = 1.6083 \pm 0.0012$

B. Bleaney, M.E.D. Scovill, R.S. Trenam, Proc. Roy. Soc. 223A, 15 (1954).

Nd^{144} τ $\sim 1.5 \times 10^{15} \text{y}$ ppl
 60 84
 $\sim 1.5 \times 10^{15} \text{y}$ α 1.9
 Natural Nd purified to constant α spectrum
 Shell model suggests Nd^{144} assignment
 E.C. Waldron, V.A. Schultz, T.P. Kohman, Phys. Rev. 93, 254 (1954).

Nd^{145} $|\mu|$ 0.62 para
 60 85
 stable q ~ 1
 B. Bleaney, M.E.D. Scovill, R.S. Trenam, Proc. Roy. Soc. 223A, 15 (1954).

Sm $\text{Sm}(\alpha, \alpha' \gamma)$ $E_\alpha = 3.0$
 γ 0.082 scin
 0.122

H.P. Heydenburg, G.M. Temmer, Phys. Rev. 93, 906 (1954).

Sm^{146} τ $5 \times 10^{17} \text{y}$ Nd (40-Mev α) chem
 62 84
 $5 \times 10^{17} \text{y}$ α 2.55 ppl
 τ from yield relative to $410^d \text{Sm}^{145}, 47^h \text{Sm}^{153}$

D.C. Dunlavy, G.T. Seaborg, Phys. Rev. 92, 206 (1953).

Sm^{147} I 7/2 8
 62 85
 $1.5 \times 10^{11} \text{y}$ μ -0.76
 $|q| < 1$
 $\mu(\text{Sm}^{147})/\mu(\text{Sm}^{149}) = 1.20$
 K. Murakawa, Phys. Rev. 93, 1232 (1954).

Sm^{149} I 7/2 8
 62 87
 stable μ -0.64
 $|q| < 1$
 K. Murakawa, Phys. Rev. 93, 1232 (1954).

Sm^{150} Resonance (ev) $\text{Sm}(n)$
 62 88
 stable 0.0962 $\sigma_0 = 111,000$ $\Gamma = 0.0855$
 Data indicate existence of a lower resonance
 A.W. McReynolds, E. Andersen, Phys. Rev. 93, 195 (1954).

Sm^{150} Resonance (ev) $\text{Sm}(n)$ $E_n = 0.08$ to 0.16 ev
 62 88 0.096 $\Gamma_n/\Gamma = 0.0082$ $J = 4$
 stable
 B.N. Brockhouse, Can. J. Phys. 31, 432 (1953).

Capture γ 's $\text{Sm}(n, \gamma)$ s pr
 0.074 5.99 0.34 7.24
 0.064 6.54 0.034 7.89
 0.044 6.79

Also graph $E_\gamma = 2.5$ to 8
 *Probably not g.s. γ which would be M3 or E4
 †Photons per 100 n captures in Sm

B.B. Kinsay, G.A. Bartholomew, Can. J. Phys. 31, 1051 (1953).

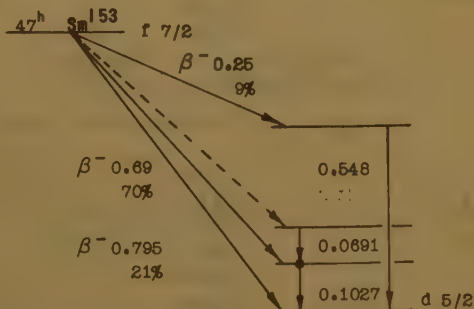
Sm^{153} β^{--} 32% 0.64 s1
 62 91 49% 0.70
 47^h 19% 0.81

γ 100% 0.0890 $\alpha = 6$ slice⁻ scin
 $K/L > 4.6$
 0.1026 $K/L > 6.1$
 $\tau = 4.0 \times 10^{-9} \text{s}$ βce^-
 0.544 0.1717 $\tau = 1.4 \times 10^{-10} \text{s}$ βce^-
 w 0.520
 (0.64 β) (0.089 γ) (0.70 β) (0.1025 γ)
 **Spectrum analysed only for $E_\beta > 0.35$

R.L. Graham, J. Walker, Phys. Rev. 94, 794A (1954); * verbal report.

$\text{Sm}(\text{pile } n)$ $\gamma \gamma$ scin
 γ 0.070 $\alpha_K = 3.8$ M1 + E2 x/γ
 0.102 $\alpha_K = 1.1$ $\tau = 3.4 \times 10^{-9} \text{s}$
 0.070 γ precedes 0.102 γ
 F.K. McGowan, Phys. Rev. 93, 163 (1954).

β^- 9% 0.26 $\text{Sm}^{152}(\text{pile } n)$ s1
 70% 0.685
 21% 0.795
 α_K K/L s1 ce^-
 γ 0.0691 4
 0.1027 0.6 6 M1 + E2
 0.548 0.008 6



M.R. Lee, R. Katz, Phys. Rev. 93, 155 (1954); 92, 848A (1953).

⁶³ ₁₃ Eu ¹⁵²	γ		Eu ¹⁵¹ (pile n)	STT
		0.1212	ce ⁻ (Sm)	
		0.2436	ce ⁻ (Gd)	
		0.344	ce ⁻ (Gd)	
		0.98	a	

Eu¹⁵¹ impurity in Sm¹⁵² sample

M.R. Lee, R. Katz, Phys. Rev. 93, 155 (1954); 85, 1038 (1952).

⁶³ ₁₆ Eu ¹⁵⁴	β^-	0.71	Eu ¹⁵³ (pile n)	STT
	γ	0.1224	STT ce ⁻ (Gd)	
		1.17	a	

Eu¹⁵³ impurity in Sm¹⁵⁴ sample

M.R. Lee, R. Katz, Phys. Rev. 93, 155 (1954); 85, 1038 (1952).

⁶³ ₁₇ Eu ¹⁵⁵	β^-	84%	0.152	STT
		16%	0.252	Sm ¹⁵⁴ (pile n, $\gamma\beta^-$)
	γ		0.0187	STT ce ⁻
			0.0593	
			0.0858	K/L = ~4
			0.1045	K/L = 6.1
			0.1309	
			0.1368	

M.R. Lee, R. Katz, Phys. Rev. 93, 155 (1954).

Gd		Gd (α, γ)	$E_\alpha = 3.0$	
	γ	0.082	scin	
		0.124		

N.P. Haydenburg, G.M. Temmer, Phys. Rev. 93, 906 (1954).

Capture γ 's	Gd (n, γ)	a pr
0.3†	5.61	0.5† 6.73
0.2†	5.87	0.03† 7.36
0.2†	6.41	0.03† 7.78

Also graph $E_\gamma = 3$ to 8

†Photons per 100 n captures

S.B. Kinsey, G.A. Bartholomew, Can. J. Phys. 31, 1091 (1953).

⁶⁴ ₁₈ Gd ¹⁵⁹	β^-	~0.9	Gd (pile n)	
		~1.1	a $\beta\gamma$	
	γ	0.0575	STT ce ⁻	
		0.364		
		(~0.9 β) (0.36 γ)	(~1.1 β) (0.06 γ)	
		No (K x ray) (0.36 γ)		

W.C. Jordan, J.M. Cork, S.B. Burson, Phys. Rev. 92, 315 (1953).

⁶⁴ ₃₆ Gd ¹⁶¹	τ	3.73 ^m 10	Gd (pile n)	
	β^-	~1.6	a	
	γ	0.102	scin	
		0.165 ?		
		0.316		
		0.360		
	x	K x ray (Tb)	crit a	
		(0.102 γ) (0.316 γ)	(0.36 γ) (K x ray)	
		No (0.316 γ) (0.36 γ)		
		(β) (all γ 's and K x ray)		

W.C. Jordan, J.M. Cork, S.B. Burson, Phys. Rev. 92, 315 (1953).

⁶⁵ ₈₁ Tb ¹⁴⁹	$\alpha/\epsilon > 2 \times 10^{-3}$	Gd (75-Mev p)	chem
	4.1 ^h		

M.A. Rollier, J.O. Rasmussen, Jr., Rend. acad. nazl. Lincei 14, 526 (1953); UCRL-2079.

⁶⁵ ₈₉ Tb ¹⁵⁴	τ	17.2 ^h	Eu (50-Mev α)	chem
	β^+	1.66	scin	
		2.75		
	ce ⁻	0.188		
		0.233		
		0.281		
		0.322		
		0.374		
		0.517		
		0.549		

M.A. Rollier, J.O. Rasmussen, Jr., Rend. acad. nazl. Lincei 14, 526 (1953); UCRL-2079.

⁶⁵ ₇₃ Tb ¹⁶⁰	β^-	60%	0.590	a β ce ⁻
		40%	0.850	a

L. Ya Shvartvalov, Izvest. Akad. Nauk Ser. Fiz. 17, 503 (1953); Chem. Abstr. 48-2489d (1954).

γ	K/L	STT ce ⁻
	0.0863	$L_1 < L_2$
	0.0934	
	0.1961	~3
	0.2148	>2
	0.2976	>5
	0.391	
	0.759	
	0.873	~5
	0.960	~5
	1.174	
	1.265	

(0.86 β) (0.086 γ , 0.873 γ , 0.960 γ) a $\beta\gamma$ scin
 (0.52 β) (0.086 γ , 0.196 γ , 0.215 γ , 0.298 γ)
 (0.52 β) (0.873 γ , 0.960 γ , 1.17 γ)
 (0.086 γ) (0.215 γ , 0.298 γ , 0.873 γ , 1.17 γ)
 (0.196 γ) (0.086 γ , 0.215 γ , 0.759 γ)
 (0.215 γ) (0.759 γ , 0.960 γ)
 (0.298 γ) (0.873 γ , 0.960 γ)

No 0.306 β No 0.176 γ

S.B. Burson, W.C. Jordan, J.M. LeBlanc, Phys. Rev. 94, 103 (1954).

⁶⁵ ₈₁ Tb ¹⁷⁰	τ	~17 ^h	Eu (50-Mev α)	chem
	β^-	2.34	scin	

M.A. Rollier, J.O. Rasmussen, Jr., Rend. acad. nazl. Lincei 14, 526 (1953); UCRL-2079.

⁶⁵ ₈₁ Tb ¹⁷⁰	τ	>17 ^h	Eu (50-Mev α)	chem
	β^+	3.1	scin	
	ce ⁻	0.06	0.15	
		0.09	0.21	
		0.13		

M.A. Rollier, J.O. Rasmussen, Jr., Rend. acad. nazl. Lincei 14, 526 (1953); UCRL-2079.

Dy^{161} I 7/2⁺ 8
 66 93 $\mu(Dy^{161}) \mu(Dy^{163}) \sim 1$
 stable K. Murakawa, T. Kamei, Phys. Rev. 92, 323 (1953).

Dy^{163} I 7/2⁺ 8
 66 97 stable K. Murakawa, T. Kamei, Phys. Rev. 92, 325 (1953).

Dy^{165} γ 0.106 K/LM = 0.15 sl ce⁻
 66 99 1.2^m Dy(slow n)
 G. Weber, Z. Naturf. 9A, 115 (1954).

β^- (0.84) (calc) Dy(pile n), γ ppl
 γ 0.108 $\alpha_K \sim 4$ scin, γ ce⁻ ppl
 K : L_g : L_g : M : N
 3 : 10 : 10 : 5 : 1.5
 0.16
 0.36
 0.515
 (0.16 γ) (0.36 γ)

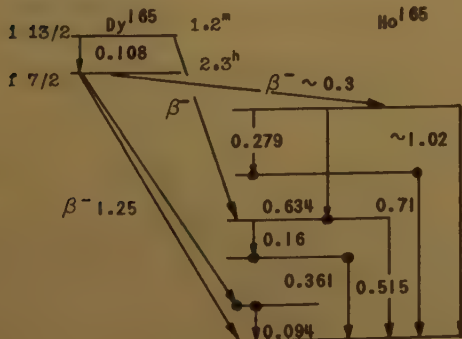
W.C. Jordan, J.M. Cork, S.B. Burson, Phys. Rev. 92, 1218 (1953); 91, 497A (1953).

Dy^{165} τ_2 2.4^h Dy(slow n)
 66 99 γ 0.0927 K/LM = 2.7 sl ce⁻
 2.32^h G. Weber, Z. Naturf. 9A, 115 (1954).

γ 0.0944 scin, γ ce⁻ ppl
 K : L : M
 60 : 7.8 : 1.5
 0.279 K/L > 5
 0.361 K/L > 5
 0.634
 0.71
 ~ 1.02

(~ 1.28) (0.094 γ) (~ 0.36) (all other γ 's)
 (0.28 γ) (0.71 γ) (0.63 γ) (0.36 γ) No other γ

W.C. Jordan, J.M. Cork, S.B. Burson, Phys. Rev. 92, 1218 (1953); 91, 497A (1953).



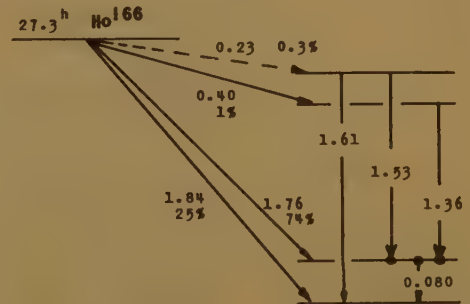
W.C. Jordan, J.M. Cork, S.B. Burson, Phys. Rev. 92, 1218 (1953).

Ho^{161} τ 2.5^h d 3.6^hEr chem
 67 94 Er(24-Mev D), Dy(p)
 2.5^h γ 0.090 scin
 0.17
 X K x ray
 NO 0.511 γ

T.H. Handley, E.L. Olson, Phys. Rev. 93, 524 (1954).

Ho^{163} τ <30^m or >1^y d 75^mEr chem
 67 96 No 5^d activity (<0.01% 4.6^hHo) Dy(24-Mev D)
 T.H. Handley, E.L. Olson, Phys. Rev. 92, 1260 (1953).

Ho^{166} β^- $\sim 0.3\%$ (0.23)
 67 99 1% (0.40)
 27.3^h 74% (1.76) $\beta\gamma$
 25% (1.84)
 γ 85% 0.080 $\alpha_K = 1.9$ K/L = 0.25 scin
 10% 1.36
 2% 1.53
 $\sim 1\%$ 1.61
 (0.080 γ)(1.36 γ , 1.53 γ)
 NO 0.170 γ (<0.0 γ) NO 1.44 γ (<2%)



A.W. Sunyar, Phys. Rev. 93, 1345 (1954).

Resonances $Ho^{165}(n)$ $E_n = 0.1$ to 30 eV
 3.96 $\sigma_{f, 77}^{2n}$ cryst s
 12.8 $\sigma_{f, 300}^{2n}$
 10
 22
 39

H.L. Foote, Jr., H.H. Landon, V.L. Sailor, Phys. Rev. 92, 656 (1953); 90, 362A (1953).

Er^{160} τ 30^h Ta¹⁸¹ (350-Mev D) MS
 68 92 30^h M.C. Michel, D.H. Tempieton, Phys. Rev. 93, 1422 (1954).

Er^{161} τ 3.5^h Ta¹⁸¹ (350-Mev D) MS
 68 93 3.6^h M.C. Michel, D.H. Tempieton, Phys. Rev. 93, 1422 (1954).

Er ¹⁶¹ 68 93 3.6 ^h	τ	3.6 ^h	Er (17-Mev p) chem Not by Ho(p), Er(n, γ)	Yb ¹⁶⁹ 70 99 31.8 ^d	τ	32 ^d	ms
γ		0.065 0.1957 0.824 1.120	scin				

No 0.511 γ

T.H.Handley, E.L.Olson, Phys. Rev. 93, 524 (1954).

Er ¹⁶³ 68 95 75 ^m	τ	75 ^m	Ho ¹⁶⁵ (19-Mev p) chem				
γ		0.43 1.10	scin				

No β^+ (<1%) τ of daughter <50^m or >1^y

Mass assignment from 19-Mev threshold

T.H.Handley, E.L.Olson, Phys. Rev. 92, 1260 (1953).

Tm ¹⁶⁵ 69 96 24.5 ^h	τ	29 ^h	Ta ¹⁸¹ (350-Mev p) ms				

M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

τ	24.5 ^h	Er (>12-Mev p) chem	
γ	0.205 0.808 1.16 1.38	p 9.9 ^h Er chem scin	

No β^+ (<1%)

T.H.Handley, E.L.Olson, Phys. Rev. 92, 1260 (1953).

Tm ¹⁶⁶ 69 97 7.7 ^h	τ	7.7 ^h	ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

Tm ¹⁶⁷ 69 98 9.6 ^d	τ	9.6 ^d	ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

Tm ¹⁷⁰ 69 101 127 ^d	Resonances	Tm ¹⁶⁹ (n)	$E_n = 0.1$ to 30 eV 3.92 eV $\sigma_0 \Gamma^2 \sim 380$ cryst s
			14.8 17.6

H.L.Foots, Jr., M.H.Landon, V.L.Sallor, Phys. Rev. 92, 656 (1953); 90, 362A (1953).

Yb	γ	Yb ($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$ scin
		0.082	

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93, 351 (1954).

Yb ¹⁶⁸ 70 96 58 ^h	τ	58 ^h	ms

M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

Lu	Resonances	Lu (n)	$E_n = 0.03$ to 35 eV cryst s
		E_n (eV) $\sigma_0 \Gamma^2$	

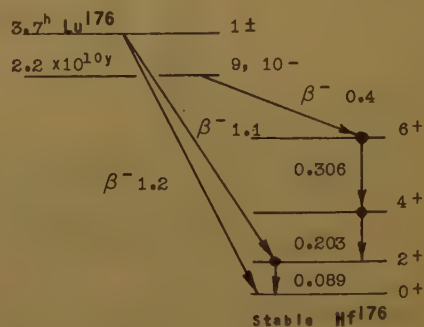
0.142	1.4
1.57	0.9
2.62	6
4.80	21
5.30	45
11.4	58
14.4	(560)*
20.6	
24	
31	

*2 or more unresolved resonances

Lu ($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$
γ	0.077 0.113 0.184?

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954).

Lu ¹⁷⁶ 71 105 2.2x10 ^{10y}	τ	2.15 x 10 ^{10y}	289 γ 's/sec/g Lu scin
γ	0.6† 3.3† 3.7†	0.089 0.203 0.306	

 $\epsilon/\beta^- < 0.1$ assuming x rays from conversion of E2 γ 's

J.A.Arnold, Phys. Rev. 93, 743 (1954).

Hf	γ	Hf ($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$ scin
		0.093 0.112	

N.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954).

Hf ¹⁷¹ 72 99 16 ^h	γ	0.63* 1.02*	Yb (56-Mev α) chem scin

*Could belong to 23.6^h Hf¹⁷³

A.H.Wapstra, C.Jongejans, Physica 20, 36 (1954).

Hf ¹⁷³ 72 101 23.6 ^h	γ	100†	0.121	Yb (56-Mev α) chem scin	Hf ¹⁸¹ 72 109 46 ^d	β^-	0.405	Hf (slow n) s	K : L ₂ : L ₃ : MN [†]
		75†	0.299						
		w	0.63°						
		w	1.02°						
		x	90†	K x ray					

*Could belong to 16^hHf¹⁷¹

A.H.Wapstra, C.Jongejans, Physica 20,36 (1954).

Hf ¹⁷⁵ 72 103 70 ^d	γ	0.0895	K : L : M = 30 : 15 : 1.5
		0.340	K : L : M = 100 : 20 : 5

Hf (slow n)

A.A.Bashilov, N.M.Anton'eva, B.S.Dzhelepov,
A.I.Dolgentseva, Izvest. Akad. Nauk Ser. Fiz.
SSSR 17, 437 (1953); Chem. Abstr. 48-2489h (1954).

Hf ¹⁷⁸ 72 106 stable	Resonances	Hf ¹⁷⁷ (n)		chopper	
		E ₀ (ev)	$\sigma_0 \Gamma^2$	σ_0	Γ
		1.02	110	~55,000	~0.045
		2.34	280	>30,000	<0.10
		5.7	52	> 2,400	<0.15
		6.5	80	> 7,200	<0.11
		8.8	55	> 3,800	<0.12
		13.6	28	> 450	<0.25

Capture γ 's per pile n capture = 4.1

L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O.
Muehlhaue, Phys. Rev. 92,1527 (1953); 87,222A
(1952).

Hf ¹⁷⁹ 72 107 stable	Resonance	Hf ¹⁷⁸ (n)		chopper
		7.6 ev	$\sigma_0 \Gamma^2 \sim 1400$	

Capture γ 's per pile n capture = 3.5

L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O.
Muehlhaue, Phys. Rev. 92,1527 (1953); 87,
222A (1952).

Hf ¹⁸⁰ 72 108 5.5 ^h	γ	0.0576	M3	scin
		0.0933	E2	
		0.2155	E2 $\tau < 10^{-6}$ s	
		0.3330	E2 $\tau < 10^{-6}$ s	
		0.4435	E2 $\tau < 10^{-6}$ s	

(0.444 γ)(0.333 γ)(θ) $\Delta I = 2$ for each γ
(0.444 γ)(0.216 γ)(θ)

J.W.Miethlich, G.Scharff-Goldhaber, W.McKeown,
Phys. Rev. 94, 794A (1954); verbal report.

Hf ¹⁸⁰ 72 118 stable	Resonance	Hf ¹⁷⁹ (n)		chopper
		5.6 ev	$\sigma_0 \Gamma^2 \sim 25$	

$\Gamma < 0.1$

L.M.Bollinger, S.P.Harris, C.T.Hibdon, C.O.
Muehlhaue, Phys. Rev. 92,1527 (1953); 87,
222A (1952).

Hf ¹⁸¹ 72 109 46 ^d	τ	46 ^d u	$\beta\gamma$
		(0.133) $\tau = 18.8^{+4.5}$	

N.S.Murdoch, Proc. Phys. Soc. 66A, 944 (1953).

*ce⁻ per 100 β 's

A.A.Bashilov, N.M.Anton'eva, B.S.Dzhelepov,
A.I.Dolgentseva, Izvest. Akad. Nauk Ser. Fiz.
SSSR 17, 437 (1953); Chem. Abstr. 48-2489h (1954).

γ	Hf ¹⁸⁰ (pile n) γ ce ⁻ scin	
	a_k	x/y
	0.132	0.48 E2
	0.135	1.9 M1
	0.345	0.08

0.480 0.034 M1, E2 or E1, M2
K/LM = 4

F.K.McGowan, Phys. Rev. 93, 163 (1954).

γ	E2 M1		$\gamma\gamma(\theta)$
	(0.132)	100%	
	(0.135)	20%	
	(0.345)	50%	
	(0.480)	60%	

(0.132 γ)(0.480 γ)(θ) I = 5/2, 9/2, 7/2
(0.345 γ)(0.135 γ)(θ) I = 9/2, 9/2, 7/2

F.K.McGowan, Phys. Rev. 93, 471 (1954).

Ta ¹⁸¹ 73 108 stable	γ	Ta ¹⁸¹ (D, D ⁺ γ) E _p = 2.0		s ce ⁻
		0.137	I	

0.166 I

T.Huus, J.H.Bjerregaard, Phys. Rev. 92,1579,
(1953).

γ	Ta ¹⁸¹ (D, D ⁺ γ) E _p = 4		scin
	(0.137)	I = 9/2	
	(0.303)	I = 11/2	

D₀ γ (θ)
D₀ γ (θ)

W.J.Goldburg, R.M.Williamson, Phys. Rev. 94,
747A (1954); verbal report.

γ	Ta ¹⁸¹ (D, D ⁺ γ) E _p = 3		scin
	100†	0.139 I = 9/2	
	100†	0.167	

80† 0.309 I = 11/2 D₀ γ (θ)

J.T.Eisinger, C.F.Cook, C.M.Class, Phys. Rev.
94, 735, 747A (1954).

γ	Ta ¹⁸¹ (α , α' γ) E _{α} = 3.0		scin
	0.137		

G.M.Temmer, N.P.Heydenburg, Phys. Rev. 93,351
(1954).

W¹⁸⁷
 74 113
 23.9^h (0.480 γ) (0.072 γ , 0.134 γ , 0.208 γ) scin
 (0.134 γ) (0.072 γ , 0.480 γ)
 E. Gernagnoli, A. Malvicini, L. Zappa, Nuovo Cim. 10, 1388 (1953).

Os¹⁹³ β^- W 0.6 $\beta(\text{ce}^-)$ scin
 76 117 W 0.82
 31^h W 0.96
 W 1.03
 1.10

Re Resonances Re(n) $E_n = 0.003$ to 10^8 ev
 E_n (ev) time of flight
 2.18* $\sigma_0 = 5700$ $\Gamma = 0.09$
 4.40** $\sigma_0 = 2000$ $\Gamma = 0.05$
 $\sigma_0 \Gamma^2$
 5.92 2.88
 7.18 15.0
 11.3** 29.6
 13.1 19.0
 17.7 44.7
 21.1 19.4

γ (0.073) $\tau = 6.0 \times 10^{-98}$ sl ce^-
 (0.139) $\tau < 2 \times 10^{-98}$ sl $\beta(\text{ce}^-)$
 (0.251)?
 (0.281) $\tau < 2 \times 10^{-98}$
 (0.321)
 (0.460)
 (0.558)?

No 0.106 γ No 0.328 γ

H. de Waard, Physica 20, 41 (1954).

*Re¹⁸⁵ **Re¹⁸⁷

E. Melkonian, W. W. Havens, Jr., L. J. Rainwater, Phys. Rev. 92, 702 (1953).

Ir Ir($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$ scin
 γ 0.129

M. P. Heydenburg, G. M. Temmer, Phys. Rev. 93, 906 (1954).

γ Re($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$ scin
 0.130

M. P. Heydenburg, G. M. Temmer, Phys. Rev. 93, 906 (1954).

Ir¹⁹¹ I 3/2 8
 77 114 μ +0.2
 stable q +1.5

W. von Siemens, Ann. Physik 13, 136 (1953).

Re¹⁸⁶ β^- 27% ~ 0.9 s
 75 111 73% 1.06
 3.0^d γ 0.087 s ce^-
 0.1234
 0.1383 K: L: M = 0.9: 3: 1
 0.1647

N. M. Anton'eva, A. A. Bashilov, B. S. Dzhelepov, L. S. Chervinskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 507 (1953); Chem. Abstr. 48-2490b (1954).

Ir¹⁹² γ_1 1.45^m Ir(slow n)
 77 115 1.4^m G. Weber, Z. Naturf. 9A, 115 (1954).

$\beta^- \sim 0.1\%$ Ir(slow n); a
 γ IT 99.9% 0.056 $\alpha \geq 1000$ s ce^-
 No continuous ce^- (< 3%) a
 No continuous γ (< 0.1%) a

G. Weber, A. Flammersfeld, Z. Naturf. 8a, 580, (1953).

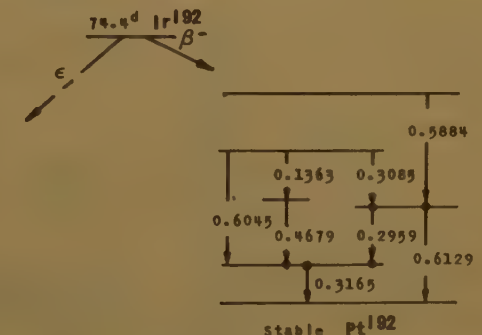
Re^{189?} τ 9.8^m Os(26-Mev n) chem
 75 114 β^- 1.8 a
 9.8^m

A. H. W. Aten, Jr., G. D. de Feyfer, Physica 19, 1143 (1953).

Ir¹⁹² (0.296 γ)(0.309 γ)(0.317 γ) 4 π scin
 77 115 (0.468 γ)(0.317 γ)
 74.4^d (0.588 γ)(0.613 γ)

Os γ Os($\alpha, \alpha'\gamma$) $E_\alpha = 3.0$ scin
 0.157
 0.180
 0.188
 0.202

M. P. Heydenburg, G. M. Temmer, Phys. Rev. 93, 906 (1954).



D. C. Lu, M. L. Wiedenbeck, Phys. Rev. 94, 501 (1954).

Os¹⁹¹ γ Os(pile n) scin
 76 115 0.129 $\alpha_K = 2.1$ M1 + E2 x/y
 35^d No β (0.129 γ), no $\beta(\text{ce}^-)$ 0.129 γ
 F. K. McGowan, Phys. Rev. 93, 163 (1954).

Au^{181}	τ	$\sim 4^h$	$d\ 57^m\text{Hg}$
$79\ 112$	γ	0.0480	$est\ ce^-$
$\sim 4^h$		0.0910 $L_2/L_3 = 1.2$	
		0.130	
		0.1587	

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Au^{195}	γ	0.0569 $\alpha \sim \infty$	E3
$79\ 116$		$L_2/L_3 = 1.05$	
30^s		0.2615 $\alpha_K = 0.25$	M1 + E2
		K:L:M = 100:18:5.3	
		0.318	
		$d\ 40^h\text{Hg}$, not $d\ 9.5^h\text{Hg}$	

O.Huber, J.Halter, R.Joly, D.Maeder, J.
Brunner, Helv. Phys. Acta 26, 591A (1953).

Au^{191-3}	τ	2.0^s	Hg(p); Tl(p)
$79\ 2^s$	No γ		scin
	Mass assignment from thresholds (values not stated)		

A.Menrikson, S.W.Breckon, J.S.Foster, Proc.
Roy. Soc. Canada 47, 127A (1953).

γ	0.0565	$L_2/L_3 = 1$	E3	$est\ ce^-$
		$M_2/M_3 = 1$		
		$L/M = 1.8$		
	0.2616	$K/L_1 = 5.5$	M1	
		$d\ 40^h\text{Hg}$, not $d\ 9.5^h\text{Hg}$		

Au^{192}	τ	4.8^h	Au(p); Hg(p)	chem
$79\ 113$	γ	0.137	0.402	s
4.8^h		0.158	0.415	ce^- (Pt)
		0.168	0.437	
		0.188	0.467	
		0.205	0.588	
		0.282	0.612	
		0.296	0.765	
		0.316	1.135	

G.T.Ewan, A.L.Thompson, Proc. Roy. Soc.
Canada 47, 126A (1953).

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954); 89,
908A(1953).

Au^{195}	γ	0.0308	$L_2/M = 3$	M1	$est\ ce^-$
$79\ 116$		0.0988	$K/L \geq 4$	M1	
185^d			$L_1:L_2:L_3 = 70:10:3$		
			$d\ 9.5^h\text{Hg}$		

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954).

γ	20†	0.2958	$d\ 5.7^h\text{Hg}$	$est\ ce^-$
	40†	0.3168		
	†Relative intensity of ce^-			

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Au^{197}	γ	0.130	$d\ 23^h\text{Hg}$, Au(n,n'),	scin
$79\ 118$		0.277	K:L:M = 100:18:4.7	
7.4^s			$\alpha_K = 0.29$	M1 + E2
		0.407	$K/LM = 2.3$	
			$\alpha \sim \infty$	M4 crossover

O.Huber, J.Halter, R.Joly, D.Maeder, J.
Brunner, Helv. Phys. Acta 26, 591A (1953).

Au^{193}	τ_1	$< 1^h$	$d\ 12^h\text{Hg}$
$79\ 114$	γ	0.0319	$L_2/L_3 = 0.65$ E3 <i>est</i>
$< 1^h$		0.2181*	$K:L_2:L_3 = 13:8:8$
	100†	0.2579	$K/L = 5.4$ M4
	$< 3^\dagger$	0.2906	

*Not placed in decay scheme. See Hg¹⁹³

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954); 89,
908A(1953).

Au^{197}		Au($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$	scin
$79\ 118$	γ	0.077		
stable		0.190		
		0.277		

M.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906
(1954).

Au^{193}	τ_2	17.4^h	Au(p); Hg(p)	chem
$79\ 114$	γ	0.0997	0.2551	s
17.4^h		0.1123	0.2679	ce^- (Pt)
		0.1555	0.3164	
		0.1733	0.4396	
		0.1859		

G.T.Ewan, A.L.Thompson, Proc. Roy. Soc.
Canada 47, 126A (1953).

γ	0.1124	$est\ ce^-$
	0.1735	$d\ 12^h\text{Hg}$, $d\ 4^h\text{Hg}$
	0.1862	

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Au^{197}	(D, D' γ)	$E_p = 2$ to 4
γ	0.195 ?	scin
	0.277	I = 5/2
	0.545	I = 7/2
		D, $\gamma(\theta)$

W.I.Goldburg, R.W.Williamson, Phys. Rev. 94,
747A(1954); verbal report.

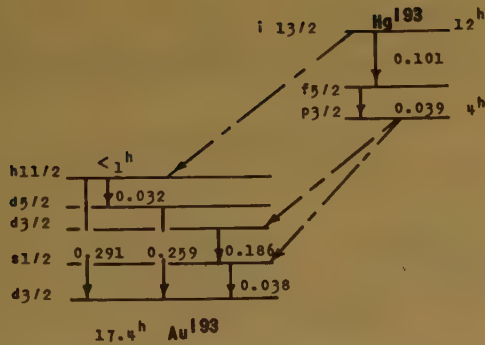
Threshold	0.42	
Levels*	1.2	scin
	■	

*Slight increases in slope of σ curve

M.C.Martin, B.C.Oliver, R.F.Taschek, Phys. Rev.
93, 199(1954); 92, 1096A(1953).

Au¹⁹⁷		Au(n,n')^{7.4}Au E_n = 0.53 to 2.0		Hg		Hg(α,α'γ) E_α = 3.0	
79 118	Threshold	0.53			γ	0.163	scin
stable	Levels*	1.14	scin				
		1.44					
	*Sharp increases in slope of σ curve						
	A.A.Ebel, C.Goodman, Phys. Rev. 93, 197 (1954).						
				Hg^{<191}	τ	~25 ^m	Au(65-Mev p) chem
				80 ^{<111}		0.0286	L ₁ /M ₁ ~ 2 ce ⁻ (Au)
				25 ^m			L ₁ :L ₂ :L ₃ = 3:1:1
							L.P.Gillion, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).
	μ	0.14	8				
	q	+0.56					
	W. v. Siemens, Ann. Physik 13, 158 (1953).						
Au¹⁹⁸	β ⁻	0.025%	1.371	ΔI = 3, yes	al		
79 119	γ	0.82%	0.6765	α _K = 0.022 M1 32%			
2.69 ^d				K/L = 5.7			
		0.16%	1.0889	α _K = 0.0045 E2 100%			
				K/L = 6.3			
	L.G.Elliott, M.A.Preston, J.L.Wolfson, Can. J. Phys. 32, 153 (1954).						
	γ	100 † (0.41)					
		1.3 † (0.68)					
		0.25† (1.09)					
	D.Waeder, R.Müller, V.Wintersteiger, Helv. Phys. Acta 27, 3 (1954).						
	γ	(0.68)	E2 60% M1 40%	γγ(θ)			
		(0.68γ)(0.41γ)(θ)	I = 2, 2, 0				
	C.D.Schrader, Phys. Rev. 92, 928 (1953).						
	Resonance	Au ¹⁹⁷ (n)	cryst s				
		4.91ev σ ₀ = 31,000* Γ = 0.18*					
		σ ₀ Γ ² = 782**					
	*From peak of resonance						
	**From wings of resonance						
	H.M.Landon, V.L.Saller, Phys. Rev. 93, 1030 (1954).						
	Capture γ's	Au ¹⁹⁷ (n,γ)	s pr				
	3 †	4.59	1.8† 6.15				
	1.7†	5.20	6 † 6.249				
	1.3†	5.52	2.8† 6.310				
	1.0†	5.70	2.1† 6.45				
	1.0†	5.97	1.5† 6.495*				
	Also graph E _γ = 3.5 to 7.6						
	E _γ (Au ¹⁹⁷) = 6.4 from Au ¹⁹⁷ (d,p)						
	*Probably not Au ¹⁹⁸ g.s. γ which would be M2						
	†Photons per 100 n captures						
	G.A.Bartholomew, B.B.Kinsay, Can. J. Phys. 31, 1025 (1953).						
				Hg^{<191}	τ	~25 ^m	Au(65-Mev p) chem
				80 ^{<111}		0.0286	L ₁ /M ₁ ~ 2 ce ⁻ (Au)
				25 ^m			L ₁ :L ₂ :L ₃ = 3:1:1
							L.P.Gillion, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).
				Hg^{<191}	τ	90 ^m	Au(65-Mev p) chem
				80 ^{<111}	Weak ce ⁻		scin ce ⁻
				90 ^m			
							L.P.Gillion, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).
				Hg^{<191}	τ	~3 ^h	Au(65-Mev p) chem
				80 ^{<111}	ce ⁻	0.08802	scin ce ⁻
				~3 ^h	ce ⁻ shows no growth		
							L.P.Gillion, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).
				Hg¹⁹¹	τ	57 ^m	Au(60-Mev p) chem
				80 ¹¹¹	γ	0.2526	scin ce ⁻
				57 ^m		0.2741	
					e ⁻	0.0111 e _A or ce _M ⁻	0.0139γ
							L.P.Gillion, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).
				Hg¹⁹²	γ	0.0313	M1(E1?) scin ce ⁻
				80 ¹¹²			L ₁ :L ₂ :L ₃ = 47:10:10
				5.7 ^h		0.1143	K/L ₁ = 5 M1
						0.1423	K/L ₁ = 3
						0.1460	K/L ₁ = 5 M1
						0.1574	K/L ₁ = 3.5
						0.275	Au(45-Mev p) chem
							L.P.Gillion, K.Gopalakrishnan, A. de-Shalit, J.W.Mihelich, Phys. Rev. 93, 124 (1954).
				Hg¹⁹³	γ	0.0392	L ₁ ce ⁻ only M1 scin ce ⁻
				80 ¹¹³		0.1012	L ₁ /L ₃ = 0.27 M4
				12 ^h		0.342*	K/L ₁ = 8
							D < 1 ^h Au 84% D 4 ^h Hg 16%
							*Not placed in decay scheme
							27 ^h activity not found for Hg ¹⁹³
				Hg¹⁹³	γ	0.0379	L/M = 5.3 M1 + E2 scin ce ⁻
				80 ¹¹³			L ₁ :L ₂ :L ₃ = 30:85:40
				4 ^h		0.1865	Au(35-Mev p) chem

Hg¹⁹³
80 113



L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg¹⁹⁵
80 115
9.5h

$\tau_{1/2}$	9.5h	not p 30 ^a Au
γ	0.0614	$L_1 L_2 / L_3 = 1.8$
	0.179	
	0.600	
100†	0.779	$\alpha_K = 0.016$ K/LM = 4.3
40†	1.15	

O.Huber, J.Halter, R.Joly, D.Maeder, J.
Brunner, Helv. Phys. Acta 26, 591A (1953).

γ	0.061	Au(35-Mev D)
	0.180	ST ce ⁻
	0.500	
	0.780	

D.G.Douglas, A.L.Thompson, Proc. Roy. Soc.
Canada 45, 173A (1951).

Hg¹⁹⁴
80 114
0.4s

τ_1	0.40 ^s	Au(D); Hg(D)
γ	0.048	scin
	0.134	M3 or E3 from τ

Mass assignment from thresholds (values not stated)

A.Henriksen, S.W.Breckon, J.S.Foster, Proc.
Roy. Soc. Canada 47, 127A (1953).

γ	0.0612	M1 + E2 STce ⁻
		$L_1 : L_2 : L_3 = 12 : 11 : 10$
	0.1798	K/L > 4 M1
		ce ⁻ (0.0612 γ)/ce ⁻ (0.1798 γ) = 29
		NO 0.262 γ (< 10%) Au(25-Mev D) chem

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954).

Hg¹⁹⁵
80 115
40h

τ_1	40h	
γ	0.0371	$\alpha \sim \infty$ $L_1/L_2 \sim 10$
		$L : M : N = 100 : 33 : 18$
	0.1227	$\alpha \sim 200$ $L_2/L_3 \sim 0.3$
		$K : L : M = 100 : 442 : 20$
	0.559	$\alpha_K = 0.028$
		$K : L : M = 100 : 19 : 4.6$

D 9.5^hHg 50% D 30^aAu 50%

O.Huber, J.Halter, R.Joly, D.Maeder, J.Brunner
Helv. Phys. Acta 26, 591A (1953).

γ	0.037	Au(35-Mev D)
	0.056	ST ce ⁻
	0.122	ce ⁻ (Hg)
	0.1307	
	0.206	
	0.261	
	0.318	
	0.558	

D.G.Douglas, A.L.Thompson, Proc. Roy. Soc.
Canada 45, 173A (1951).

γ	0.0369	M1 STce ⁻
		$L_1 : L_2 : L_3 = 10 : 2 : \sim 0$
	0.1226	K/L = 0.2 M4
		$L_1 : L_2 : L_3 = 10 : 2 : 20$
		L/M = 2

D 9.5^hHg 48% D 30^aAu 52% Au(25-Mev D) chem

L.P.Gillon, K.Gopalakrishnan, A. de-Shalit,
J.W.Mihelich, Phys. Rev. 93, 124 (1954); 89,
908A (1953).

Hg¹⁹⁷
80 117
65h

γ	0.0776	$\alpha = 2.5$ d 28 ^h Hg
		$L_1 L_2 / L_3 = 5$
	0.192	$\alpha_K = 0.9$ M1
		$K : L : M = 100 : 16 : 4.8$

O.Huber, J.Halter, R.Joly, D.Maeder, J.Brunner,
Helv. Phys. Acta 26, 591A (1953).

Hg¹⁹⁸
80 118
stable

Level	Hg(γ, γ')	$E_\gamma = 0.411$
		(0.411) $\tau = 2.2 \times 10^{-11}$ s
Source rotated to compensate for recoil		
*With statistical weight factor of 5		

W.G.Davey, P.B.Moon, Proc. Phys. Soc. 66A,
956 (1953).

Hg¹⁹⁹
80 119
stable

Level	Hg(γ, γ')	$E_\gamma = 0.209$
		(0.209) $\tau = 3.1 \times 10^{-10}$ s
Source heated to compensate for recoil		

F.R.Metzger, W.B.Todd, Phys. Rev. 94, 794A
(1954); J. Franklin Inst. 257, 248 (1954).

Hg²⁰⁰
80 120
stable

Capture γ 's	Hg(n, γ)	s pr
2†	4.66	3† 5.39
4†	4.73	5† 5.65
3†	4.83	12† 5.959
1†	4.95	5† 6.446
3†	5.07	0.3† 6.6 ?
		0.3† 7.1 ?

Also graph $E_\gamma = 2.5$ to 7.5
†Photons per 100 captures in Hg

B.B.Kinsey, G.A.Bartholomew, Can. J. Phys. 31,
1051 (1953).

Hg²⁰¹ Q 0.6 **HgCl₂** quad res
 80 121 stable H.G. Dehmelt, H.G. Robinson, W. Gordy, Phys. Rev. 93, 480 (1954); 93, 920A (1954).

Hg²⁰¹ τ_1 $< 1^m$ or $> 10^m$ **Hg²⁰⁴** (≤ 20 -Mev γ)
 80 121 No γ activity ($< 1\%$ of expected M₄ IT)

I. Bergström, R.D. Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Hg²⁰³ τ_1 $< 1^m$ or $> 10^m$ **Hg²⁰⁴** (≤ 20 -Mev γ)
 80 123 No γ activity ($< 1\%$ of expected M₄ IT)

I. Bergström, R.D. Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Hg²⁰³ β^- 0.22 **Hg**(pile n); sl
 80 123 γ 0.279 $\alpha_K = 0.14$ sl ce^-
 47^d $K/LM = 2.57$

No 0.498 β ($< 1.5\%$)

A.H. Wapstra, D. Maeder, G.J. Nijgh, L.Th.M. Ornstein, Physica 20, 169 (1954).

Hg[?] Unassigned ce^- **Au**(D) chem; $sc\gamma ce^-$

A = 190, 191 0.0488 0.0634 0.0846
 0.0617 0.0738

A = 191 0.0186 0.0690 0.1994 0.2511
 0.0270 0.1161 0.2054

A = 192 0.0332 0.0440 0.0910 0.1819
 0.0393 0.0850 0.1238
 0.0436 0.0904 0.1648

L.P. Gillon, K. Gopalakrishnan, A. de-Shalit, J.W. Michael, Phys. Rev. 93, 124 (1954).

Tl $Tl(\alpha, \gamma)$ $E_\alpha = 3.0$ $scin$
 γ 0.220?

G.W. Temmer, W.P. Heydenburg, Phys. Rev. 93, 351 (1954).

Capture γ 's $Tl(n, \gamma)$ s pr
 $7\uparrow$ 4.72 $4\uparrow$ 5.90
 $4\uparrow$ 4.91 $8\uparrow$ 6.20
 $7\uparrow$ 5.25 $4\uparrow$ 6.54
 $17\uparrow$ 5.63

Also graph $E_\gamma = 2.5$ to 8

$B_n(Tl^{203}) = 8.5$; $B_n(Tl^{203}) = 6.2$ from $Tl(d, p)$

\uparrow Photons per 100 n captures

G.A. Bartholomew, S.B. Kinsey, Can. J. Phys. 31, 1025 (1953).

Tl¹⁹⁷ τ_1 0.54^s **Hg**(D); **Tl**(D)
 81 116 γ 0.384 $\alpha = 2.7$ $scin$
 0.54^s Mass assignment from thresholds (values not stated)

A. Henriksen, S.W. Breckon, J.S. Foster, Proc. Roy. Soc. Canada 47, 127A (1953).

Tl¹⁹⁸ τ_1 1.75^h **Au¹⁹⁷** (40-Mev α); ms
 81 117 1.8^h

M.C. Michel, D.H. Templeton, Phys. Rev. 93, 1422 (1954).

τ_1 1.9^h **Hg**(11-Mev d) chem
 γ 0.0487 $sc\gamma ce^-$
 0.2607 $K/L = 0.6$ M₄
 $L_1/L_2 = 1.33$
 0.2824 M₁ + E₂
 $(ce_K^- 0.261\gamma) / (ce_K^- 0.282\gamma) = 1.45$

I. Bergström, R.D. Hill, G. de Pasquall, Phys. Rev. 92, 918, 849A (1953).

Tl¹⁹⁸ τ_2 5.3^h **Au¹⁹⁷** (40-Mev α); ms
 81 117 5.3^h M.C. Michel, D.H. Templeton, Phys. Rev. 93, 1422 (1954).

τ_B 5^h **Hg**(11-Mev d) chem
 γ 0.195
 0.284
 0.402
 0.411
 0.675
 $(0.411\gamma) / (0.675\gamma) \sim 10$

I. Bergström, R.D. Hill, G. de Pasquall, Phys. Rev. 92, 918, 849A (1953).

Tl¹⁹⁹ τ 7.4^h **Au¹⁹⁷** (40-Mev α); ms
 81 118 7.4^h M.C. Michel, D.H. Templeton, Phys. Rev. 93, 1422 (1954).

γ 0.0500 **Hg**(11-Mev d) chem
 0.1584 $sc\gamma ce^-$
 0.2081
 0.2472 $L_1/L_2 \sim 10$ M₁
 0.3336
 0.4546 No $L_3 ce^-$ M₁
 0.4913 No $L_3 ce^-$ M₁

Not p 44^m **Hg**(0.367 γ not observed)

I. Bergström, R.D. Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Tl²⁰⁰ τ 27^h Au^{197} (40-Mev α); ms
 81 119
 27^h M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

γ 0.116* Hg(11-Mev d) chem
 0.252 γ ce^-
 0.289
 0.3678 K/L = 2.0 $L_1 L_2 / L_3 = 3.0$
 0.579
 0.629
 0.660*
 0.786*
 0.829

*Assignment doubtful

I.Bergström, R.D.Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Tl²⁰⁸ $\Gamma(e_K^- 0.277 \gamma) \sim 80$ ev γ
 81 127
 3.1^m This is expected width of K electron level
 M.Siñis, Arkiv Fysik 6, 415 (1953).

Tl[?] Unassigned ce^- Hg(11-Mev d) chem
 $\tau = 5^h$ to 27^h 0.0369 0.0376 0.1326 γ ce^-
 $\tau = 6^h$ 0.458 0.473 0.503 0.513
 0.465 0.480 0.508
 $\tau = 27^h$ 0.0814 0.0997 0.2717 0.3038
 0.0829 0.1371 0.2935
 0.0838 0.2260 0.2996
 $\tau = ?$ 0.1651 0.3326 0.582 0.667
 0.1887 0.3336 0.604 0.667
 0.1959 0.3824 0.618
 0.2015 0.414 0.640

I.Bergström, R.D.Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Tl²⁰¹ γ 0.0305* M1 ? γ ce^-
 81 120
 3^d 0.0321* M1 ?
 0.1353 $L_1 / L_2 \sim 10$ M1
 0.1676 $L_1 / L_2 \sim 10$ M1
 No 0.21 γ No 0.55 γ
 *Only L_1 ce^- observed Hg(11-Mev d) chem

I.Bergström, R.D.Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Tl²⁰² γ 0.4391 K/L = 2.6 γ ce^-
 81 121
 12^d $L_1 L_2 / L_3 = 3.6$ E2
 No other γ Hg(11-Mev d) chem
 I.Bergström, R.D.Hill, G. de Pasquall, Phys. Rev. 92, 918 (1953).

Tl²⁰⁶ No long-lived activity found for Tl²⁰⁶ ms
 81 125
 4.19^m M.C.Michel, D.H.Templeton, Phys. Rev. 93, 1422 (1954).

Tl²⁰⁸ β^- 1.25* 8
 81 127
 3.1^m 1.6*
 1.8*

γ $\sim 6^h$ (0.277) γ ce^- scin, s ce^-
 32† (0.511) E2 63% M1 37%
 (0.511 γ)(2.62 γ)(θ) I(3.71 level) = 5
 88† (0.583) $\alpha_K = 0.015$ E2
 $\tau = 2.4 \times 10^{-10}$
 (0.583 γ)(2.62 γ)(θ) I = 5, 3, 0
 11† (0.860) E2 > 99.9%
 (0.860 γ)(2.62 γ)(θ) I = 4, 3, 0
 $\sim 0.6^h$ (1.094)
 100† (2.615) $\alpha_K = 0.0018$ E3

L.G.Elliott, R.L.Graham, J.Walker, J.L.Wolfson, Phys. Rev. 93, 356 (1954); 94, 795A (1954); * verbal report.

Pb γ Pb(n,n' γ) $E_n = 3.9$ scin
 0.85
 2.60

M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954); 92, 1097A (1953).

No γ Pb(D,D' γ) $E_p = 3$ scin

C.M.Class, C.F.Cook, J.T.Eisinger, Phys. Rev. 94, 809A (1954).

No γ Pb(α , α' γ) $E_\alpha = 3.0$ scin

M.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954).

Pb²⁰¹ τ 8.4^h Tl(28-Mev d) chem
 82 119
 8.4^h γ 100† 0.325 K/LM = 5 sl ce^-
 33† 0.583

A.H.Wapstra, D.Maeder, G.J.Nijgh, L.Th.M.Ornstein, Physica 20, 169 (1954).

Pb²⁰² τ_1 3.5^h Tl(26-Mev d) chem
 82 120
 3.5^h γ 45† 0.123 E4 scin, sl ce^-
 1.2† 0.322 E5
 102† 0.416 E2
 9† 0.455 M1
 40† 0.657 E1
 64† 0.784 E5
 98† 0.957 E2

†Relative intensities of $\gamma + ce^-$

D.Maeder, A.H.Wapstra, Phys. Rev. 93, 1433 (1954).

²⁰³ Pb	γ	0.280	scin
82 121		3.0† 0.403	$\alpha_K = 0.062$ E2 87%
52 ^h	(0.403 γ)(0.280 γ)(θ)		I = 5/2, 3/2, 1/2
	0.7† 0.683		

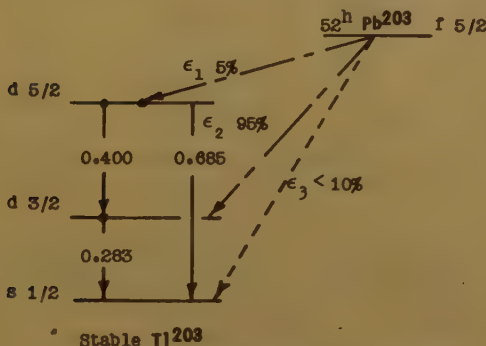
J. Varma, Phys. Rev. 94, 795A (1954); verbal report; J. Franklin Inst. 257, 247 (1954).

		Tl (28-Mev d) chem; sl ce^-	
γ	82.3† 0.279	K/LM = 2.65 L/MN = 3.5	
	3.8† 0.400	$\alpha_K = 0.12$	
		K/LM = 4.9 L/MN = 4.5	
	0.7† 0.678	$\alpha_K = 0.009$	
	(0.400 γ)(0.279 γ)		scin
	$E_{d1s} = 1.8 \pm 0.5$ from $\epsilon_K/\epsilon = 0.74 \pm 0.06$		
	based on 0.279 γ/x_K in Hg^{203} and Pb^{203}		

A. H. Wapstra, D. Maeder, G. J. Nijgh, L. Th. M. Ornstein, Physica 20, 169 (1954).

		Tl (20-Mev d) chem; d $^{12}B^{11}$ chem	
γ_1	100† 0.280	scin	
γ_2	4.7† 0.400	$\tau \leq 10^{-78}$	
γ_3	0.87† 0.685		
$\gamma_1\gamma_2$	$x_K\gamma_1$	$x_K\gamma_2$	
	$\gamma_1\gamma_2(\theta)$ consistent with I = 5/2, 3/2, 1/2		
	$\epsilon_1(K)/\epsilon_1(L) = 3$	$\epsilon_2(K)/\epsilon_2(L) = 7$	
	consistent with $E_{d1s} = 1.4$		
	No $\epsilon_3 (< 10\%)$		

J. R. Prescott, Proc. Phys. Soc. 67A, 254 (1954).



J. R. Prescott, Proc. Phys. Soc. 67A, 254 (1954).

²⁰⁴ Pb	0.374 level		
82 122	μ	+0.14 σ	$\gamma\gamma(\theta, H)$
68 ^m	Mass assignment of $68^{m}Pb$ confirmed		Tl ²⁰³ (d, n)

H. Frauenfelder, J. S. Lawson Jr., W. Jentschke, Phys. Rev. 93, 1126 (1954).

γ	(0.905) E4 90% M5 10% $\gamma\gamma(\theta)$	
	(0.905 γ)(0.374 γ)(θ)	I = 6 ⁺ , 2 ⁺ , 0 ⁺
	E4, M5 assignment based on $\alpha_K = 0.06$	

H. Frauenfelder, J. S. Lawson, Jr., W. Jentschke, G. DePasquall, Phys. Rev. 92, 1241 (1953).

²⁰⁵ Pb	τ	> 10 ⁶ y	
82 123		No long-lived Pb activity observed from	
~10 ⁶ y		Tl (20-Mev d) or decay of 14.5 ^d Bi; chem	

P. F. D. Shaw, J. R. Prescott, Proc. Phys. Soc. 67A, 283 (1954).

²⁰⁷ Pb	τ	0.84 ^s	d ~ 50 ^y Bi chem
82 125			
0.82 ^s		E. C. Campbell, ORNL-1620 (1953).	

(ce_K^- 1.06y) (0.56y) (θ) d ~ 50^yBi
I = 13/2, 5/2, 1/2 scin

F. K. McGowan, Phys. Rev. 92, 524 (1953).

²¹⁰ Pb	β^-	0.023 s	pc
82 128			
22 ^y		F-K plot linear to ~6 kev	

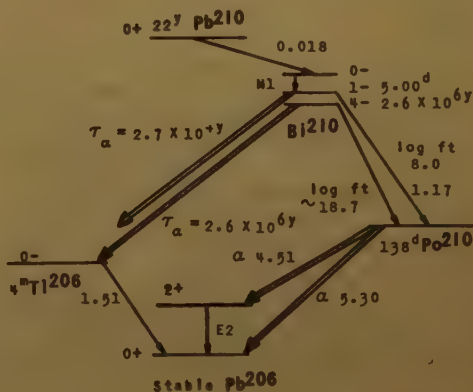
E. Hueter, Z. Physik 136, 303 (1953); Naturwiss. 40, 197 (1953); Phys. Rev. 92, 1076 (1953).

γ	(0.047)	s
	$L_1 : L_2 : L_3 : M : NO$	
	39 : 6 : 0.35 : 10 : 3.1 [*] M1	
ce^-	0.3 [*] 0.0319	origin unknown
	No 0.0075 transition	
	* ce^- per 100 decays	

A. A. Bashilov, B. S. Dzhelepov, L. S. Chervenskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 428 (1953); Chem. Abstr. 48-24901 (1954).

Not p 2.6×10^{6y} Bi $< 10^{-4}\%$
No long-lived α 's in Bi extracted from U ore

H. B. Levy, I. Perlman, Phys. Rev. 94, 152 (1954).



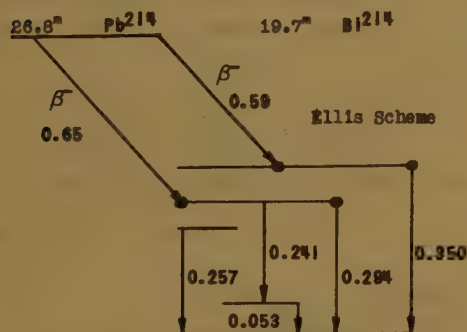
Pb²¹² γ (0.229) τ between (20 and 2) $\times 10^{-14}$ s
 82 130
 10.6^h
 From diffraction of x rays following internal conversion in crystal containing Pb²¹².

J.W.Knowles, Phys. Rev. 94, 795A (1954);
 *verbal report.

$\Gamma(e^- 0.239\gamma), \Gamma(e^- 0.300\gamma) \sim 80$ ev
 This is expected width of K electron level

H.Silfvis, Arkiv Fysik 6, 415 (1953).

Pb²¹⁴ β^- 50% 0.59 **Rn²²²** 87
 82 132 44% 0.65
 26.8^m
 (0.59 β) (ce⁻0.35 γ) (0.65 β) (ce⁻0.29 γ)
 No (ce⁻0.38 γ) (ce⁻0.29 γ , ce⁻0.24 γ)
 Supports decay scheme of Ellis



S.Kagayama, J. Phys. Soc. Japan 8, 689 (1953).

Bi²⁰⁶ γ K : L₁ L₂ : L₃ : M
 83 123 0.2025 0.084 : 0.57 : 0.26 : 0.2
 6.4^d 0.516 18 : 10 : 2 : 3
 $\tau = 150 \mu$ s

Both γ 's interpreted as E3 from 7- fifth excited state at 2.200 in Pb²⁰⁶

D.E.Aiburger, M.H.L.Pryce, Phys. Rev. 92, 514, (1953).

Bi²⁰⁷ γ 100 % 0.555 $\alpha_K = 0.015$ $\tau < 10^{-9}$ s E2
 83 124 81.5% 1.055 $\alpha_K = 0.096$ $\tau = 0.8$ s M4
 ~30^y (1.06 γ) (0.56 γ) (0) I = 13/2, 5/2, 1/2 scin
 No other γ 's

F.K.McGowan, E.C.Campbell, Phys. Rev. 92, 523, (1953)

γ 1.0639 3 87 $\sqrt{2}$
 K/L = 3.95
 K/LM = 3.00

D.E.Aiburger, Phys. Rev. 92, 1297 (1953).

Bi²⁰⁹ Levels **Bi²⁰⁹ (n,n')** $E_n = 2.4$ scin
 83 126 0.22 \dagger 9.4
 Stable? 0.06 \dagger 0.9
 0.08 \dagger 1.3
 $\dagger d\sigma/d\omega$ at $\sim 90^\circ$
 M.d.Poola, Phil. Mag. 44, 1398 (1953).

Levels **Bi²⁰⁹ (n,n')** $E_n = 2.5$ scin
 γ 0.85
 1.58

E.A.Elliot, D.Wicks, L.E.Baghian, M.Halban, Phys. Rev. 94, 144 (1954).

Bi²⁰⁹ (n,n') $E_n = 3.9$ scin
 γ 0.91
 1.63
 2.60
 3.35

M.A.Rothman, C.E.Mandeville, Phys. Rev. 93, 796 (1954).

Bi²⁰⁹ (p,p') $E_p = 3$ scin
 No γ

C.M.Class, C.F.Cook, J.T.Eisinger, Phys. Rev. 94, 809A (1954).

Bi²⁰⁹ (α,α') $E_\alpha = 3.0$ scin
 No γ

G.M.Temmer, M.P.Haydenburg, Phys. Rev. 93, 351 (1954).

Bi²¹⁰ I 0 γ
 83 127 No hfs in λ 306 γ indicating g_I small
 5.00^d

M.Fred, F.S.Tomkins, R.F.Barnes, Phys. Rev. 92, 1324 (1953).

β^- 1.170 10 8
 A.A.Bashilov, B.S.Dzhelepov, L.S.Chervinskaya, Izvest. Akad. Nauk Ser. Fiz. SSSR 17, 428 (1953).

e^-_A 20 \dagger 0.075 $^\circ$
 8 \dagger 0.080 $^\circ$
 10 \dagger 0.086 $^\circ$

*Auger electrons from inner bremsstrahlung
 Same lines observed in decay of 60.5^mBi²¹²

E.T.Novakow, Bull. bel. Cons. Acad. Yugoslavie 1, 11 (1953); Phys. Abstr. 57-3817 (1954).

Bi²¹⁰
83 127
2.6x10⁶y

$T_{1/2}$ 2.6 x 10⁶ y
From difference between σ_t and $\sigma(5.0^d\text{Bi})$

D.J. Hughes, H. Palevsky, Phys. Rev. 92, 1206 (1953).

Ra²²⁴ α 4.0% 5.445
88 136
3.64^d (5.681)

F. Asaro, F. Stephens, Jr., I. Perlman, Phys. Rev. 92, 1495 (1953).

α 4.94 2 Bi²⁰⁹ (slow n) ms
No γ , no e⁻ scin, ppl
D 138.4^d Po 0.37% D 4.19^m Tl 99.65%
Not d 28^y Pb²¹⁰ < 10⁻⁴%

No long-lived α 's in Bi extracted from Uore

H.B. Levy, I. Perlman, Phys. Rev. 94, 152 (1954).

γ 0.2411 $\alpha_K = 0.13$ Ra²²⁴ 87 ce⁻
 $\alpha_{L3} \sim 0.08$ E2

0.24098 γ reported by Muller et al,
Phys. Rev. 88, 775 (1952) in source of
Th²²⁸ + decay products, assigned here

S. Rosenblum, M. Valadarez, M. Guillet, J. Phys. Radium 15, 129 (1954); Compt. rend. 234, 1767 (1952).

Bi²¹²
83 129
60.5^m

α 5.481
5.603
5.622
5.765
6.047
6.086

A. Rytz, J. recherches centre nat'l. recherche sci. Labs. Bellevue No. 25, 254 (1953).

Ra²²⁶ γ 290⁺ 0.188 K/LM = 0.45 cc
88 138
1620^y $\alpha_K = 0.15^*$ E2
38⁺ 0.66

*Assuming 4.61 α in 6.4% of disintegrations

R.R. Roy, M.L. Goes, Compt. rend. 238, 469 (1954).

Bi²¹⁴
83 131
19.7^m

β^- 20% 1.00? Rn²²² 8 π
57% 1.65
23% 3.2

S. Kageyama, J. Phys. Soc. Japan 8, 689 (1953).

γ 0.66 E2 cc
(4.2x) (0.66 ce⁻) (θ) I = 0, 2, 0
(4.2x) (0.19 ce⁻) (θ) graph*
*Maximum is symmetric about 90°

R.R. Roy, M.L. Goes, Compt. rend. 238, 581 (1954).

$\gamma\gamma$ (θ) found as f(Pb absorber thickness)
Results suggest I = 2, 2, 0 for (1.76 γ) (1.12 γ)
I = 2, 2, 0 for (2.09 γ , 1.24 γ) (0.808 γ)

F. Demichelis, R. Malvano, Phys. Rev. 93, 526 (1954); Nuovo Cim. 10, 405, 1359 (1953); Rend. acad. nazl. Lincei 14, 259 (1953).

Ra²²⁸ $\sim 4\%$ L X ray crit a
88 140 No 0.03y (< 1%) crit a
6.7^y

M. Riou, Ann. Phys. 8, 535 (1953).

Ac²²⁸
89 139
6.13^h γ K L₁ L₂ L₃ MN⁺
0.057 24 20 15
0.078 ~ 0.1
0.097 3.3

0.127 0.13 3.3 2.3 1.8
0.184 4.7 1.0 0.3
d Ra²²⁸ chem sl
ce⁻/dis = 0.81 Higher energy γ 's not studied
(< 0.060 ce⁻) / (> 0.060 ce⁻) ~ 1
e_A/dis = 0.32 x₁/dis = 0.29 (estimated)
*ce⁻ per 100 disintegrations

W.D. Brodie, Proc. Phys. Soc. 67A, 265 (1954).

Po²¹⁰
84 126
138.4^d

τ 138.37^d 3
0.5 millicurie sample counted 328 days in
low geometry α counter

M.L. Curtis, Phys. Rev. 92, 1489 (1953).

Po²¹²
84 128
0.30 ^{μ s}

α 10⁶+ 8.777
35+ 9.488
20+ 10.417
170+ 10.536
No other α with E _{α} \leq 11.29 (< 1.7⁺)

A. Rytz, J. recherches centre nat'l. recherche sci. Labs. Bellevue No. 25, 254 (1953). *Compt. rend. 233, 790 (1951).

Th²²⁷ α $\sim 2\%$ 5.651 Ra(n) chem; s
90 137 15% 5.704 $\sim 2\%$ 5.922
18.6^d $\sim 1\%$ 5.728 13% 5.952
17% 5.749 21% 5.972
2% 5.796 5% 6.001
4% 5.860 19% 6.030

Th ²²⁷	γ	0.02997	$L_2/L_3 = 0.33$	E2
90 137		0.03164	$L_2/L_3 = 0.33$	E2
18.6 ^d		0.05016		E1
			$L_1 : L_2 : L_3 = 7 : 8 : 10$	
		0.06163	$L_2/L_3 = 0.9$	E2
		0.06867		

Study of higher energy γ 's in progress

M. Frilley, S. Rosenblum, M. Valadares, G. Boulassieres, J. Phys. Radium 15, 45 (1954).

Th ²³⁰	γ	0.0618 e ⁻ (previously unassigned) attributed to L_3 e ⁻ of 0.0878 γ (E2)
90 140		
8.0x10 ^{4y}		

M. Riou, Ann. Phys. 8, 535 (1953).

Th ²²⁸	α_2	15%	5.21		Dpl
90 138	α_1	27%	5.34		
1.90 ⁷	α	58%	(5.42)		
	α_1^0		[ce ⁻ (0.084 γ)]		
	α_2		[~0.08 ce ⁻]		

C. J. D. Jarvis, Proc. Phys. Soc. 66A, 1074 (1953)

γ	(0.068)	$\tau < 10^{-8}$	90% Th ²³⁰
(α) (0.088 γ) (θ)	I = 0, 2, 0		scin

G. M. Temmer, J. M. Wyckoff, Phys. Rev. 92, 913; 849A (1953).

(α) (0.088 γ) (θ)	I = 0, 2, 0	1c
(α) (0.142 γ) (θ)	I = 0, 4, 2	

P. Faik-Valrant, J. Tellier, G. Valladas, P. Benoit, Compt. rend. 238, 1409 (1954).

α	0.2%	5.173	28 % 5.388	s
	0.4%	5.208	71 % 5.421	
γ	16 †	0.089	$\alpha \sim 16$	E2 scin
	2.6†	0.137	$\alpha \ll 1$	E1
	0.9†	0.169	$\alpha \sim 1.2$	E2
	2.7†	0.212	$\alpha \ll 1$	E1

†Photons per 10³ α 's

F. Asaro, F. Stephens, Jr., I. Perlman, Phys. Rev. 92, 1495 (1953).

Th ²³²	Level	Th ²³² ($\alpha, \alpha'\gamma$)	$E_\alpha = 3.0$	scin
90 142	γ	0.050		
1.4x10 ^{10y}				

G. M. Temmer, M. P. Heydenburg, Phys. Rev. 93, 351 (1954).

γ	0.08447	E2	511 ce ⁻
		$L_2/L_3 = 1.19$	

ce⁻ now attributed to single γ

S. Rosenblum, M. Valadares, M. Guillot, J. Phys. Radium 15, 129 (1954); Compt. rend. 235, 238 (1952).

\bar{E}_α	3.99 2	Dpl
α	(25%) 3.95*	
	(75%) 4.00*	

*From analysis of spectrum into two groups differing by 0.065-Mev

G. Philibert, J. Génin, L. Vigneron, J. Phys. Radium 15, 16 (1954).

γ	100 †	0.0844	Th ²²⁸ source separated
	10.6†	0.132	from daughters
	6 †	0.167	pc
	18 †	0.214	

No Ra K x ray (<0.06†)

 γ spectra taken at intervals after separation to identify γ 's of daughters

J. O. Newton, B. Rose, Phil. Mag. 45, 58 (1954).

Th ²³⁴	β^-	35%	0.100	511 $\beta\gamma$
90 144		65%	(0.191)	
24.1 ^d			(0.100 β)(0.090 γ)	

E. F. deHaan, G. J. Sizoo, P. Kramer, Physica 19, 1201 (1953).

Th ²³⁰	α	0.06%	4.209	~100% Th ²³⁰ ms	Pa ²³⁰	β^-	Th ²³² (26-Mev d)	chem
90 140		0.07%	4.293		91 139	β^+	0.2	511 $\sqrt{2}$
8.0x10 ^{4y}		0.08%	4.363		17.7 ^d		0.4	
		0.07%	4.439			γ	0.0486	511 $\sqrt{2}$ ce ⁻
		0.20%	4.474				0.0889	
		0.07%	4.546				0.0995	
		23.4%	4.619				0.462	
		76.3%	(4.685)			ce ⁻	0.417	
							0.424	

S. Rosenblum, M. Valadares, J. Blandin-Vlat, R. Bernas, Compt. rend. 238, 1496 (1954).

Ong Ping Hok, G. J. Sizoo, Physica 20, 77 (1954).

Pa^{232}				Th^{232} (26-Mev d)	chem	Pa^{234}	β^-			Pa^{234}	β^-				
91 141	β^-	74%	0.26	2%	0.715	91 143	24%	0.33		91 143	24%	0.33		87/2	
1.3 ^d		13%	0.37	6%	1.24	6-7 ^h	27%	0.95						U chem	
		5%	0.54				16%	1.15							

K/L

UX contamination 0.5 to 6%

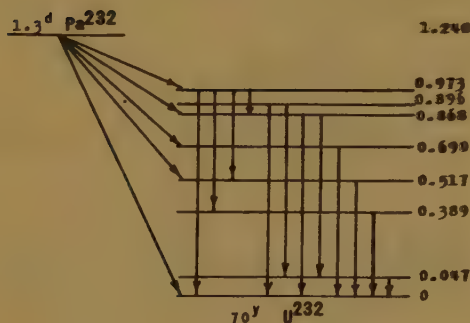
γ	0.0472	$I_2/I_3 = 1.1$	0.090	
	0.1093	$I_1/I_3 = 2.5$	0.821	4
		K/L	0.344	
	0.389	2	0.868	4
	0.455	4	0.896	> 6
	0.517	8.5	0.973	6
	0.584	~1.5	1.085	
	0.6627	< 1	1.153	

γ		0.004**	vw	0.425*	87/2
	st	0.090		0.451	Ce^-
	w	0.127		0.5067	
	st	0.153	st	0.567	
		0.200		$K/L = 6$	
	st	0.225	vw	0.600	
		$K/L = 4.5$		0.731*	
	w	0.280		0.800	
		0.293		0.877	
	st	0.369		0.924*	

* e^- only seen

**From 0.042 e^- (assumed e_1^-) and doubtful 0.059 e^- (assumed e_n^-). Note 0.044 γ in Pu^{238} decay.

Ong Ping Hok, G.J.Sizoo, Physica 19, 1205 (1953).



Ong Ping Hok, G.J.Sizoo, Physica 20, 77 (1954).

U^{232}
92 140
74^y

τ 74^y
From specific α activity; ms analysis

P.A.Sellers, C.M.Stevens, M.H.Studler, Phys. Rev. 94, 952 (1954).

Pa^{233}				Th^{232} (26-Mev d)	chem	U^{233}	I	5/2	8
91 142	β^-	37%	0.13	8%	0.43	92 141	μ	positive	
27.4 ^d		49%	0.25	6%	0.57	1.62x10 ^{5y}	q	large	

87/2 Ce^-

K.L.Vander Sluis, J.R.McNally, Jr., J. Opt. Soc. Amer. 44, 87 (1954).

γ	0.015	w	0.2726	
	0.0286	st	0.3013	
	0.0385	vst	0.3126	
	w	0.0577	st	0.3401
	st	0.0751	w	0.3763
		0.0866	w	0.3987
		0.1022	w	0.4162

Ong Ping Hok, G.J.Sizoo, Physica 22, 77 (1954).

U^{234}	α	~3%	4.593	enriched U^{234}
92 142		23%	4.707	α^- lc
2.5x10 ^{5y}		74%	(4.763)	

G.Valladas, Compt. rend. 237, 1673 (1953).

Pa^{234}	β^-			d 24.1 ^d Th	87	U^{235}	I	5/2	8
91 143		0.5%**	0.100			92 143	μ	-0.8	
1.18 ^m		1.4%	0.600			7.1x10 ^{5y}	q	~8	
		2.3%	1.500						
		96.4%	(2.305)						

γ^*	0.230	0.578 $\text{sn } \gamma(\text{Ce}^-)$	
	0.298	0.728	
	0.356	0.802	
	0.423	0.875	
	0.447	0.926	
	0.500	1.036	

*From spectrum coincident with > 0.09 γ 's

**Not measured, estimated from decay scheme

E.F.de Haan, G.J.Sizoo, P.Kramer, Physica 19, 1201 (1953).

U^{238}	Level	$U(\alpha, \gamma)$	$E_\alpha = 3.0$	scin
92 146	γ	0.044		
4.49x10 ^{9y}	No 0.424 γ^*			

W.P.Heydenburg, G.M.Temmer, Phys. Rev. 93, 906 (1954); * priv. comm.

Pu^{238} 93 145 2.1 ^d	β^-	45%	~ 0.27	U(12-Mev p)chem; sl
		55%	1.26*	
	γ	849†	0.0441	
		30†	0.1020	
		0.5†	0.9257	
		1.6†	0.939	
		3.9†	0.986	
		3.6†	1.030	$K: L_2: M_2 = 22: 8: 6$

*Combination of 1.246 and 1.290?

†ce⁻ per 1000 disintegrationsH. Slatis, J.O. Rasmussen, Jr., H. Atterling,
Phys. Rev. 93, 646 (1954).

Am^{243} 95 148 8800 ^y	τ	$3.8 \times 10^{3y} \text{ s}$	ms
	From Am^{243} to Am^{241} α activity ratio in sample with known mass ratio		

H. Diamond, P.R. Fields, J. Meach, M.G. Inghram,
D.C. Hess, Phys. Rev. 92, 1490 (1953).

α	$\sim 3\%$	5.171	Pu^{239} (pile n)	s
	13%	5.225		
	84%	5.267		

 γ 0.075 $\alpha \leq 0.25$ E1 scinNO 5.342 α (<2%)

F. Asaro, I. Perlman, Phys. Rev. 93, 1423 (1954).

Pu^{238} 94 144 90 ^y	α	0.09%	5.352	2 sources with known amounts Pu^{238}
		28%	5.452	
		72%	5.495	
	γ	0.038†	0.0438	s
		0.008†	0.099	pc
		0.001†	0.150	
	x	13†	L x ray	
†Photons per 100 α 's Cf. 6.7 ^h Pa^{234}				

F. Asaro, I. Perlman, Phys. Rev. 94, 381 (1954).

Cm^{242} 96 146 162 ^d	α	0.035%	5.964	Am^{241} (n, γ/β) chem s
		26.3%	6.066	
		73.7%	6.110	
	γ	410†	0.044	scin
		80†	0.100	
		27†	0.157	
	†Photons per 10 ⁶ α 's			

Pu^{239} 94 145 2.4x10 ^{4y}	1	1/2	8
M. Van den Berg, P.F.A. Kilnkenberg, Physica 20, 37 (1954).			

 τ $2.44 \times 10^{4y} \text{ s}$ U(n) chem
From specific α activity of four Pu samples
corrected to zero content of Pu^{238} and Pu^{240} G.W. Farwell, J.E. Roberts, A.C. Wahl, Phys. Rev.
94, 363 (1954).

Pu^{240} 94 146 6580 ^y	τ	$6.3 \times 10^{3y} \text{ s}$	U(n) chem
From specific α activity of four Pu samples with known Pu^{238} , Pu^{239} , and Pu^{240} content			

G.W. Farwell, J.E. Roberts, A.C. Wahl, Phys. Rev.
94, 363 (1954).

Am^{242} 95 147 16.0 ^h	τ	16.0 ^h 2	Am^{241} (pile n)
Counted 10 samples each for 7 half lives			

T.K. Keenan, R.A. Penneman, B.B. McInteer, J.
Chem. Phys. 21, 1802 (1953); Phys. Rev. 87,
204A (1952).

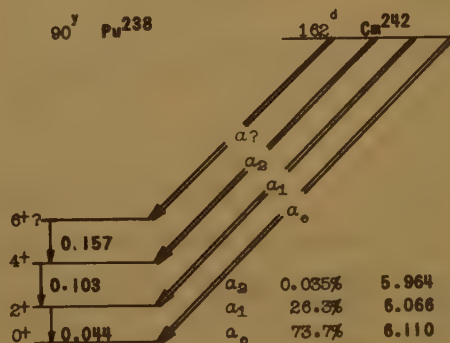
Am^{243} 95 148 8800 ^y	I	5/2	8
$\mu(\text{Am}^{241})/\mu(\text{Am}^{243}) \sim 1$			

J.G. Conway, R.D. McLaughlin, Phys. Rev. 94, 498
(1954).

Cm^{243} 96 147 $\sim 100^y$	α	13%	5.732	Cm^{242} (n, γ) chem s
		81%	5.777	
		6%	5.985	
	γ		0.226	scin
			0.278	
(5.777 α) (0.226 γ , 0.278 γ)				

F. Asaro, S.G. Thompson, I. Perlman, Phys. Rev.
92, 694 (1953).

Cm^{244} 96 148 19 ^y	α	5.755	Pu^{242} (n, γ / β) (n, γ / β) chem s
		5.798	

F. Asaro, S.G. Thompson, I. Perlman, Phys. Rev.
92, 694 (1953).F. Asaro, S.G. Thompson, I. Perlman, Phys. Rev.
92, 694 (1953).

$\text{Bk}^{249?}$ τ 97^{152} β^- $>7^d$	$>7^d$	Pu^{239} (pile n) chem	$99^{247?}$ τ 148 ϵ ? 7.3^m α	7.3^m	U^{238} (~100 Mev-N) chem
S.G.Thompson, A.Ghiorso, B.G.Harvey, G.R.Choppin, Phys. Rev. 93, 908 (1954).			A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).		
$\text{Cf}^{247?}$ τ 98^{149} ϵ $\sim 2.7^h$	$\sim 2.7^h$	U^{238} (~100-Mev N) chem	$99^{253?}$ τ 154 τ 19^d α	19.3^d 6.61	Pu (pile n) chem 1c
A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).			M.H.Studier, P.R.Fields, H.Diamond, J.F.Wech, A.M.Friedman, P.Sellers, G.Pyle, C.W.Stevens, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 93, 1428; 94, 209 (1954).		
Cf^{248} τ 98^{150} α 225^d	225^d	U^{238} (~100-Mev N) chem	τ α	20^d 6.63	$\text{d} \sim 20^d$ Cf chem 1c
A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).			G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954).		
$\text{Cf}^{>248}$ τ $98^{>150}$ α $>7^d$	$>7^d$ 5.8 6.05 6.15	Pu^{239} (pile n) chem	$99^{254?}$ τ 37^h	37^h	99 (pile n) chem
S.G.Thompson, A.Ghiorso, B.G.Harvey, G.R.Choppin, Phys. Rev. 93, 908 (1954).			P.R.Fields, M.H.Studier, J.F.Wech, H.Diamond, A.M.Friedman, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 94, 209 (1954).		
99^{246} τ 147 ϵ	minutes	U^{238} (~100-Mev N) chem	$100^{254?}$ τ 3.2^h α	3.3^h 7.17	99 (pile n) chem $\text{d } 37^h 99$ 1c
Observed only through growth of 1.5^d Cf			P.R.Fields, M.H.Studier, J.F.Wech, H.Diamond, A.M.Friedman, L.B.Magnusson, J.R.Huizenga, Phys. Rev. 93, 1428; 94, 209 (1954).		
A.Ghiorso, G.B.Rossi, B.G.Harvey, S.G.Thompson Phys. Rev. 93, 257 (1954).			τ α	3.2^h 7.22	$\text{d } 37^h 99$ chem 1c
			G.R.Choppin, S.G.Thompson, A.Ghiorso, B.G.Harvey, Phys. Rev. 94, 1080 (1954).		

2. NEUTRON CROSS SECTIONS

Absorption cross sections for neutron energies marked "th" (thermal) have been determined, from measurements in a thermal neutron flux, in terms of the cross section value of a "standard" for neutrons of velocity 2200 m/sec. or energy ~ 0.025 ev. The standard used is stated just after the reference and is generally one known to have a thermal absorption cross section with a $1/v$ energy

dependence. If the nucleus whose cross section is being measured also has a cross section with $1/v$ dependence, the cross section found for it by comparison with the standard will, of course, be a cross section for 2200 m/sec. If not, and the dependence often is not known, the value found by the comparison is $\sigma \sqrt{v/2200}$.

Target	Energy	σ	Value	Method	Ref.	Target	Energy	σ	Value	Method	Ref.
N	1.005	t	4.23		54F9	B ¹¹	14.1-18.0	t	table		54C16
	2.540	t	2.525		54F9	C	2.20	el	1.65		53R25
	14.1-18.0	t	table		54C16		14.1-18.0	t	table		54C16
	19.93	t	0.50	1	53D28		17.2-20.1	t	table		53D28
	169	t	0.049		53T20		169	t	0.323		53T20
	410	t	0.034		54N8		410	t	0.297		54N8
H ²	14.1-18.0	t	table		54C16	H ¹⁴	14	n,2n	~ 0.0034	10.1 ¹⁴ N	54D9
	169	t	0.023		53T20	O	12-18	n,p	graph	7.4 ¹⁸ N	54M2
	410	t	0.062		54N8		14.1-18.0	t	table		54C16
He	2.61-14.3	el(θ)	graphs	1c	53S69		169	t	0.430		53T20
	2.49	t	3.16		53C49		410	t	0.378		54N8
	2.99	t	2.79		53C49	F ¹⁹	19.0	t	1.84		53D28
	18.0	t	0.85		53D28	Mg	14.1-18.0	t	table		54C16
	19.0	t	0.82		53D28	Al ²⁷	2.5	el	1.0	scin	53P17
	20.1	t	0.77		53D28		2.5	n, 1.4n'	0.5	scin	53P17
Li	14.1-18.0	t	table		54C16		14.1-18.0	t	table		54C16
Li ⁶	1.5	n,H ³	0.32	ddl	54W6		19.0	t	1.84		53D28
	2.0	n,H ³	0.27	ddl	54W6		410	t	0.587		54N8
	14	n,p	0.006	ddl	54F3	Si	19.0	t	1.94		53D28
	14	n, 10.4-Mev d	0.077	ddl	54F3	Si ³⁰	pila	n, γ	0.094	2, 66 ³⁰ Si	54L3
	14	n, 13.1-Mev d	0.089	ddl	54F3	P ³¹		s coh	3.7		53P21
	14	n,H ³	0.026	ddl	54F3		0.13-0.85	t	graph		53R35
Li ⁷	~ 3	n,H ³	0.070	12.4 ⁷ H ³	54B22	S	14.1-18.0	t	table		54C16
	~ 4.5	n,H ³	0.030	12.4 ⁷ H ³	54B22		410	t	0.672		54N8
	14	n,p	< 0.005	ddl	54F3	S ³²	pila	n,p	0.15	14.3 ³² S	53R63
	14	n,H ³	0.055	ddl	54F3	Cl	410	t	0.74		54N8
Be	14.1-18.0	t	table		54C16	A	0.45-1.10	t	graph		53Q33
	410	t	0.231		54N8	Tl	1.0	el(θ)	graph	pc	54W15
B	0.001-0.036ev	t	graph	chopper	53C35	Cr	2.5	n, 1.1n'	1.0	scin	54E8
	0.0253ev	a	749°	4	53C35		0.015-10 ⁴ ev	t	graphs		54M51
	Value from 1/v line										
	< 0.2% H ₂ O by weight in B ₂ O ₃ sample										
	0.025 ev	a	755	3	53E54						
B ¹⁰	14.1-18.0	t	table		54C16						

Neutron Cross Sections continued

Neutron Cross Sections continued

Target	Energy	σ	Value	Method	Ref.	Target	Energy	σ	Value	Method	Ref.
Fe	1.0	el(σ)	graph	pc	54W13	Sn	1.0	el(σ)	graph	pc	54W13
	2.5	n, 1.8n'	1.0	scin	54E8	Sn ¹¹⁶	~14	n,p	0.9 mb	13 ³ In	53W48
	19.0	t	2.23		53D28	Sn ¹¹⁸	~14	n,p	0.8 mb	4.5 ^m In	53W48
	410	t	1.07		54N8	Sb	1.0	el(σ)	graph	pc	54W13
Fe ⁵⁴	pile	n, γ	2.2	2.9 ^v Fe	54R13	Te	1.0	el(σ)	graph	pc	54W13
	pile	n,p	0.011	320 ^d Mn	53S66	Cs ¹³³	1-9 ev	t	graph		54L12
Fe ⁵⁸	pile	n, γ	0.98	45 ^d Fe	54R13	Ba	1.0	el(σ)	graph	pc	54W13
Co ⁵⁹	1.0	el(σ)	graph	pc	54W13	Ce	1.0	el(σ)	graph	pc	54W13
Ni	1.0	el(σ)	graph	pc	54W13	Wd	0.00-3	t	graph		54O2
	2.8	el	0.9	scin	53P17	Sn	0.005-0.18 ev	t	graph		54N6
	2.8	n, 1.4n'	0.6	scin	53P17		0.00-3	t	graph		54O2
	0.002-0.8 ev	t	graph		54G21	Mo ¹⁸⁵	0.3-50 ev	t	graph		54F19
Cu	1.0	el(σ)	graph	pc	54W13	Er		s coh	7.8		53K53
	19.0	t	2.56		53D28		0.00-3	t	graph		54O2
	410	t	1.19		54N8	Ta ¹⁸⁰	0.1-50 ev	t	graph		53F19
Zn	1.0	el(σ)	graph	pc	54W13	Yb	0.00-3	t	graph		54O2
Ga	0.05-10 ⁴ ev	t	graph		53M51	Lu	0.03-35 ev	t	graph		53F19
Se	1.0	el(σ)	graph	pc	54W13	Hf	1.0	el(σ)	graph	pc	54W13
Br	17.2-20.1	t	table		53D28		1-10 ³ ev	t	graph		53B78
Sr	1.0	el(σ)	graph	pc	54W13		0.00-3	t	graph		54O2
Zr	1.0	el(σ)	graph	pc	54W13	Hf ¹⁷⁶	0.8-16 ev	t	graph		53B78
	19.0	t	3.60		53D28	Hf ¹⁷⁷	th	a	~850	osc	53B78
Nb ⁹³	1.0	el(σ)	graph	pc	54W13		0.8-16 ev	t	graph		53B78
Nb ⁹⁴	pile	n, γ	graph	35 ^d Nb	53D18	Hf ¹⁷⁸	th	a	~90	osc	53B78
Mo	1.0	el(σ)	graph	pc	54W13		0.8-16 ev	t	graph		53B78
Ru	0.01-10 ³ ev	t	graph		53M51	Hf ¹⁷⁹	th	a	~75	osc	53B78
Pd	10-50 ev	t	graph		54L12		0.8-16 ev	t	graph		53B78
Ag	1.0	el(σ)	graph	pc	54W13	Hf ¹⁸⁰	0.8-16 ev	t	graph		53B78
Cd	1.0	el(σ)	graph	pc	54W13	Ta ¹⁸¹	1.0	el(σ)	graph	pc	54W13
	0.002-0.8 ev	t	graph		54G21		0.3-50 ev	t	graph		53C45
	410	t	1.85		54N8		5-5000 ev	t	graph		53M51
In	1.0	el(σ)	graph	pc	54W13	Ta ¹⁸²	th	n, γ	$\geq 10^4$	5.2 ^d Ta	53D20
	2.5	n, 1.8n'	0.4	scin	54E8	W	1.0	el(σ)	graph	pc	54W13
	2.5	n, 1.9n'	0.2	scin	54E8		2.5	n, ~1.5n'	1.3	scin	53P17
In ¹¹⁵	0.4-1.8	n,n'	graph	4.5 ^h In	54E1		2.5	n, >2n'	1.6	scin	53P17
	0.4-5.5	n,n'	graph	4.5 ^h In	54N8	Re	0.003-10 ⁴ ev	t	graph		53M51

Neutron Cross Sections continued

Target	Energy	σ	Value	Method	Ref.
Au ¹⁹⁷	1.0	el(σ)	graph	pc	54W13
	0.4-5.0	n, n [*]	graph	7.4 ^g Au	54M8
	0.53-2.0	n, n [*]	graph	7.4 ^g Au	54H1
	2.5	n, $\sim 1.5n^*$	0.9	scin	53P17
	2.5	n, $>2n^*$	2.5	scin	53P17
	0.0253 ev	a	98.7 [*]	σ	53C35
*Value from 1/v line plus 1% for 4.9 ev res.					
	0.0013-0.036 ev	t	graph		53C35
	0.3-100 ev	t	graph		54L12
Hg	1.0	el(σ)	graph	pc	54W13
Pb	1.0	el(σ)	graph	pc	54W13
	19.0	t	5.96		53D28
	410	t	2.89		54N8
Pb ²⁰⁶	1.0	el(σ)	graph	pc	54W13
Bi ²⁰⁹	1.0	el(σ)	graph	pc	54W13
	2.4	el	2.9	scin	53P17
	2.4	n, 1.1n [*]	0.3	scin	53P17
	2.5	n, 0.9n [*]	0.6	scin	54E8
	2.4	n, 1.5n [*]	0.8	scin	53P17
	2.5	n, 1.6n [*]	1.2	scin	54E8
	19.0	t	5.69		53D28
	45-131	t	table		54L4
Th	1.0	el(σ)	graph	pc	54W13
	410	t	3.21		54N8
Th ²³⁰	th	a	26		53P23
U	0.002-0.8 ev	t	graph		54G21
	0.02-7.6	t	graph		54H17
	17-20	t	6		54H17
	18-20.1	t	table		53D28
	45-131	t	table		54L4
	410	t	3.23		54N8
Pu ²⁴²	pile	n, γ	~ 30		54S5
Pu ²⁴³	pile	n, γ	~ 100		54S5
¹⁶ Am ²⁴²	pile	n, f	2950		54H13
99 ²⁵³	pile	n, γ	~ 240	37 ^h 99 ²⁵⁴	54F14
53B78	L.W. Bollinger, S.P. Harris, C.T. Hibdon, C.O. Muchlhaus, Phys. Rev. 92, 1927 (1953); 87, 222A (1952); Based on $\sigma_a(B) = 759$.				
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53C45	R.L. Christensen, Phys. Rev. 92, 1509 (1953).				
53C49	J.H. Coon, quoted by J.D. Seagrave, Phys. Rev. 92, 122 (1953).				
53D18	D.L. Douglas, A.C. Newharter, R.P. Schuman, Phys. Rev. 92, 369, 1095A (1953).				
53D20	J.W.M. Dumond, M.C. Hoyt, F.E. Nierler, J.J. Murray, Phys. Rev. 92, 202 (1953).				
53D28	R.B. Day, R.L. Henkel, Phys. Rev. 92, 358 (1953).				

Neutron Cross Sections continued

53F19	H.L. Foote, Jr., H.H. Landon, W.L. Saffler, Phys. Rev. 92, 656 (1953).				
53G33	J.B. Guennessy, C. Goodman, Phys. Rev. 92, 323 (1953); 91, 404A (1953).				
53H35	K.F. Hansen, R.W. Klehn, C. Goodman, Phys. Rev. 92, 652 (1953).				
53H53	W.C. Koshliery, E.O. Williams, Phys. Rev. 92, 1380 (1953).				
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53H51	E. Melkonian, W.W. Havens, Jr., L.D. Reinwater, Phys. Rev. 92, 702 (1953).				
53P17	M.J. Poole, Phil. Mag. 44, 1398 (1953); Isotropy assumed.				
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53R25	R. Riccio, Nuovo Cim. 10, 1667 (1953).				
53S66	G.H. Stafford, L.H. Stein, Nature 172, 1103 (1953).				
53S69	J.D. Seagrave, Phys. Rev. 92, 122 (1953).				
53T20	A.E. Taylor, Phys. Rev. 92, 1071 (1953).				
53W48	Z. Wilhelm, R. Brunst, C. Dabrowski, Bull. Akad. Polon. Sci. 1, 109 (1953).				
54B22	H.E. Banta, R.L. Macklin, Phys. Rev. 94, 807A (1954); Science 119, 350.				
54C16	C.F. Cook, T.W. Bonner, Phys. Rev. 94, 651 (1954).				
54D9	J.D. Dudley, C.M. Glass, Phys. Rev. 94, 807A (1954).				
54E1	A.A. Ebel, C. Goodman, Phys. Rev. 93, 197 (1954).				
54E8	E.A. Elliot, D. Hicks, E.E. Beghian, H. Halban, Phys. Rev. 94, 144 (1954).				
54F3	G.W. Frye, Jr., Phys. Rev. 93, 1086 (1954).				
54F9	R.E. Fields, R.L. Becker, R.N. Adler, Phys. Rev. 94, 389 (1954).				
54F14	M.H. Studier, P.R. Fields, H. Diamond, J.F. Welch, A.M. Friedman, F. Sellers, G. Kyle, C.W. Stevens, L.B. Magnussen, J.R. Huizenga, Phys. Rev. 93, 1428 (1954).				
54G21	E. Gatti, E. Gernagnoli, G. Ferona, Nuovo Cim. 11, 262 (1954).				
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54M2	H.C. Martin, Phys. Rev. 93, 498 (1954).				
54M6	A.W. McReynolds, E. Andersen, Phys. Rev. 93, 195 (1954).				
54M8	H.C. Martin, B.C. Diven, R.F. Taschek, Phys. Rev. 93, 199 (1954); 92, 1096A (1953).				
54N8	V.A. Nedzel, Phys. Rev. 94, 174 (1954).				
54O2	A. Okazaki, S.E. Darden, R.B. Walton, Phys. Rev. 93, 461 (1954).				
54R13	S.A. Reynolds, G.W. Leddicotte, W.S. Lyon, ORNL 54-1-29 (1954); Based on $\sigma_a(Co) = 34$.				
54S5	M.H. Studier, P.R. Fields, F. Sellers, A.M. Friedman, C.W. Stevens, J.F. Welch, H. Diamond, J. Sedlet, J.R. Huizenga, Phys. Rev. 93, 1433 (1954).				
54W6	J.B. Weddell, J.H. Roberts, Phys. Rev. 93, 924A (1954).				
54W13	W. Walt, H.H. Burschall, Phys. Rev. 93, 1062 (1954).				

3. GROUND STATE Q'S

For these data it seemed impractical to follow the policy adhered to in the main list of giving the A value of a target nucleus only when enriched material was used or when the target element is known to be monoisotopic. In the following reactions, the A values assigned by the experimenters to target and product nuclei are given as superscripts. In cases where enriched material was used,

the superscript is underlined.

The standard given is that used for the measurement of the energy of either the incident or the emitted light particle whichever presented the greatest difficulty. In cases where the same standard was used for both measurements, special mention of this fact is made in the footnote giving the value assigned to the standard.

Reaction	Value	Source Detector	Stand- ard	Ref.	Reaction	Value	Source Detector	Stand- ard	Ref.
$\text{He}^3(\text{He}^3, \text{p})\text{He}^5$	+11.08	Ccw scin	range energy ^a	53M61	$\text{Se}^{77}(\text{n}, \gamma)\text{Se}^{78*}$	+10.483 ¹⁴	Pile s pr	p res	53K45
$\text{He}^3(\text{d}, \gamma)\text{Li}^5$	+16.6 ²	VdG scin	$\text{Li}^7(\text{p}, \gamma)$	54H3	$\text{Kr}^{84}(\text{d}, \text{p})\text{Kr}^{85}$	+3.72 ⁵	Cyc a		53W34
$\text{He}^5 \rightarrow \text{He}^4 + \text{n}$	+1.00 ⁸	From $\text{He}^3(\text{He}^3, \text{p})\text{He}^5\text{Q}$		53M61	$\text{Kr}^{86}(\text{d}, \text{p})\text{Kr}^{87}$	+3.30 ⁵	Cyc a		53W34
$\text{He}^5 \rightarrow \text{He}^4 + \text{n}$	+1.09 ¹⁰	From $\text{Li}^6(\text{n}, \text{d})\text{He}^5\text{Q}$		54F3	$\text{Sr}^{86}(\text{n}, \gamma)\text{Sr}^{87*}$	+8.433 ¹⁴	Pile s pr	p res	53K45
$\text{Li}^6(\text{n}, \text{d})\text{He}^5$	-2.57 ¹⁰	Ccw dpl	$\text{Li}^6(\text{n}, \text{t})$	54F3	$\text{Sr}^{87}(\text{n}, \gamma)\text{Sr}^{88*}$	+11.07 ⁶	Pile s pr	p res	53K45
$\text{Be}^8 \rightarrow 2\text{He}^4$	+0.0775 value retracted			53A34	$\text{Zr}^{91}(\text{n}, \gamma)\text{Zr}^{92*}$	+8.66 ⁴	Pile s pr	p res	53K45
$\text{B}^{10}(\text{d}, \alpha)\text{Be}^8$	+17.829 ¹⁰	Ccw s	p res	54E10	$\text{Nb}^{93}(\text{n}, \gamma)\text{Nb}^{94}$	+7.19 ³	Pile s pr	p res	53B76
$\text{B}^{10}(\text{d}, \text{p})\text{B}^{11}$	+9.227 ⁵	Ccw s	p res	54E10	$\text{Mo}^{95}(\text{n}, \gamma)\text{Mo}^{96*}$	+9.15 ⁵	Pile s pr	p res	53K45
$\text{B}^{10}(\alpha, \text{d})\text{C}^{12}$	+1.39 ¹	s		53S64	$\text{Rh}^{103}(\text{n}, \gamma)\text{Rh}^{104}$	+6.792 ¹⁴	Pile s pr	p res	53B76
$\text{B}^{10}(\alpha, \text{p})\text{C}^{13}$	+4.13 ²	s		53S64	$\text{Ag}^{107}(\text{n}, \gamma)\text{Ag}^{108*}$	+7.27 ²	Pile s pr	p res	53B76
$\text{B}^{11}(\text{d}, \alpha)\text{Be}^9$	+8.029 ⁵	Ccw s	p res	54E10	$\text{Ag}^{109}(\gamma, \text{n})\text{Ag}^{108}$	-9.07 ⁷	Stron $^{2.3\text{M}}\text{Ag}$	Q value masses	54B4
$\text{B}^{11}(\text{d}, \text{p})\text{B}^{12}$	+1.140 ⁸	VdG s	Po a ^b	53E12	$\text{Cd}^{113}(\text{n}, \gamma)\text{Cd}^{114}$	+9.046 ⁸	Pile s pr	p res	53K45
$\text{B}^{11}(\alpha, \text{p})\text{C}^{14}$	+0.85 ²	s		53S64	Mass assignment because of large σ_a (Cd^{113})				
$\text{C}^{12}(\text{d}, \text{p})\text{C}^{13}$	+2.720 ²	Ccw s	p res	54E10	$\text{Sn}^{124}(\text{d}, \text{p})\text{Sn}^{125}$	+3.52 ⁷	Cyc		53W49
$\text{N}^{14}(\text{p}, \text{n})\text{O}^{14}$	-6.0 ²	Cyc dpl		54A11	$\text{Sb}^{121}(\text{n}, \gamma)\text{Sb}^{122*}$	+6.80 ⁴	Pile s pr	p res	53B76
$\text{N}^{14}(\alpha, \text{p})\text{O}^{17}$	-1.16	Po a	dpl	53H33	$\text{Te}^{124}(\text{d}, \text{p})\text{Te}^{125}$	+4.25 ⁷	Cyc		53W49
$\text{Mg}^{26}(\text{p}, \gamma)\text{Al}^{27}$	+8.23 ⁹	Ccw scin	$\text{F}^{19}(\text{p}, \alpha\gamma)$	54K9	$\text{Pr}^{141}(\text{n}, \gamma)\text{Pr}^{142}$	+5.83 ³	Pile s pr	p res	53B76
$\text{Ne}^{20}(\text{n}, \alpha)\text{O}^{17}$	-0.70 ²		1c	53F30	$\text{Sm}^{149}(\text{n}, \gamma)\text{Sm}^{150}$	+7.89 ⁶	Pile s pr	p res	53K45
$\text{C}^{135}(\alpha, \text{p})\text{A}^{38}$	+0.81 ⁸	Cyc a		53K31	Mass assignment because of large σ_a (Sm^{149}). See Sm^{150} .				
$\text{Ca}^{40}(\text{d}, \text{p})\text{Ca}^{41}$	+6.14 ¹	VdG s		54B31	$\text{Ta}^{181}(\text{n}, \gamma)\text{Ta}^{182}$	+6.07 ⁷	Pile s pr	p res	53B76
$\text{Ca}^{40}(\text{p}, \text{n})\text{Sc}^{40}$	-15.5 ^{1.0}	Cyc	$^{0.22\text{S}}\text{Sc}$	54G9	$\text{W}^{182}(\text{n}, \gamma)\text{W}^{183*}$	+6.182 ⁸	Pile s pr	p res	53K45
$\text{V}^{51}(\text{d}, \text{p})\text{V}^{52}$	+5.072 ⁸	VdG s	Po a ^b	53S56	$\text{W}^{183}(\text{n}, \gamma)\text{W}^{184*}$	+7.42 ²	Pile s pr	p res	53K45
$\text{Ni}^{60}(\text{p}, \text{n})\text{Cu}^{60}$	-6.6 ⁴	Cyc	$^{23\text{M}}\text{Cu}$	54C15	$\text{Pt}^{194}(\text{n}, \gamma)\text{Pt}^{195*}$	+6.07 ⁴	Pile s pr	p res	53K45
$\text{Cu}^{63}(\gamma, \text{n})\text{Cu}^{62}$	-10.61 ⁵	β tron	$^{9.8\text{M}}\text{Cu}$ Q value masses	54B4	$\text{Pt}^{195}(\text{n}, \gamma)\text{Pt}^{196*}$	+7.920 ¹²	Pile s pr	p res	53K45
$\text{Cu}^{63}(\text{p}, \text{n})\text{Zn}^{63}$	-4.21			54C12	$\text{Au}^{197}(\text{n}, \gamma)\text{Au}^{198}$	+6.494 ⁸	Pile s pr	p res	53B76
$\text{Cu}^{65}(\text{p}, \text{n})\text{Zn}^{65}$	-2.12			54C12	See Au^{198} in main list.				
$\text{Zn}^{68}(\text{d}, \text{p})\text{Zn}^{69}$	+4.16 ¹⁵	scin		54E2	$\text{Tl}^{203}(\text{n}, \gamma)\text{Tl}^{204*}$	+6.54 ³	Pile s pr	p res	53B76
$\text{As}^{75}(\text{n}, \gamma)\text{As}^{76}$	+7.30 ⁴	Pile s pr	p res	53B76	$\text{Tl}^{205}(\text{n}, \gamma)\text{Tl}^{206*}$	+6.20 ³	Pile s pr	p res	53B76
$\text{Se}^{76}(\text{n}, \gamma)\text{Se}^{77*}$	+7.416 ⁹	Pile s pr	p res	53K45					

Ground State Q's continued

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 b $H_p(\text{Po } \alpha) = 331,590$. This standard was used for both incident and emitted particles.
 * For evidence for mass assignment see item (by same authors) in main list under this nucleus or appropriate element.

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4. MASS DIFFERENCES AND RATIOS

Where no superscripts have been used with H, C, and O, the weights of the most abundant isotopes, namely 1, 12, and 16 respectively, are to be understood.

Differences are given in millimass units

	Value	Ref.
$H_2 - H^2$	+1.5473 7	54M37
$H_2^2 - He$	+25.6060 47	54M37
$H_2^2 - HeH$	+25.6074 26	54M37
$2H_2^3 - C$	+84.6508 102	54M37
$2He_2 - O$	+15.5086 88	54M37
$2HeH^2 - C$	+33.4282 68	54M37
$CH_4 - O$	+36.4086 38	54M37
	+36.399 28	53E15
$N^{14} - CH_2$	-12.5999 36	54M37
	-12.591 13	53E15
$1/2(2N^{14} - C_2H_4)$	-12.589 21	53E15
$NH_3 - OH$	+23.750 8	54M37
$Si^{30} - Si^{29}$	0.49934 3	53W39
$Si^{30} - Si^{28}$		
C^{135}/C^{137}	0.945978 3	53H51
$A^{40} - C_3H_4$	-69.052 44	53E15
$3Ti^{47} - Pr^{141}$	-50.9 3	53H58

$3Ti^{48} - Nd^{144}$	-66.7 3	53H58
$3Ti^{50} - Nd^{150}$	-85.2 5	53H58
$3Cr^{52} - Gd^{156}$	-100.4 4	53H58
$3Mn^{55} - Ho^{165}$	-84.8 8	54H4
$3Fe^{56} - Er^{168}$	-126.0 3	54H4
$Ga^{69} - C_5H_9$	-144.75 4	53C20
$3Ga^{69} - Pb^{207}$	-196.6 6	53H58
$Ga^{71} - C_5H_{11}$	-161.30 8	54C20
$Ga^{70} - C_5H_{10}$	-154.30 6	54C20
$2Ga^{70} - Ce^{140}$	-56.8 6	53H58
$Ga^{72} - C_5H_{12}$	-172.35 5	54C20
$2Ga^{72} - Nd^{144}$	-66.3 2	53H58
$2Ga^{72} - Sm^{144}$	-66.9 8	54H4
$Ga^{73} - C_6H$	-84.51 3	54C20
$2Ga^{73} - Nd^{146}$	-65.8 4	54H4
$Ga^{74} - C_6H_2$	-94.68 6	54C20
$2Ga^{74} - Nd^{148}$	-74.8 2	54H4
$2Ga^{74} - Sm^{148}$	-71.9 4	54H4
$Ga^{76} - C_6H_4$	-110.05 4	54C20
$2Ga^{76} - Sm^{152}$	-76.2 3	53H58
$As^{75} - C_6H_3$	-101.79 4	54C20
$2As^{75} - Nd^{150}$	-77.4 4	54H4
$2As^{75} - Sm^{150}$	-72.5 8	54H4

MASS DIFFERENCES AND RATIOS continued

	Value		Ref.
$3e^{74} - C_6H_2$	-93.14	7	54C20
$23e^{74} - Nd^{148}$	-72.3	4	54B4
$23e^{74} - Sm^{148}$	-70.0	5	54B4
$3e^{76} - C_6H_4$	-112.06	4	54C20
$23e^{76} - Sm^{152}$	-81.4	6	53H56
$23e^{77} - Sm^{154}$	-81.8	3	54B4
$23e^{77} - Gd^{154}$	-81.0	2	54B4
$23e^{78} - Gd^{156}$	-87.5	2	53H56
$3e^{79} - 3e^{78}$	0.50081	10	53H50
$3e^{80} - 3e^{78}$			
$Hs^{80} - C_6H_9$	-146.17	4	54C20
$23e^{80} - Gd^{160}$	-94.3	2	54B4
$23e^{80} - Dy^{160}$	-91.0	8	54B4
$Hs^{82} - C_6H_{12}$	-161.66	4	54C20
$23e^{82} - Dy^{164}$	-95.2	8	54B4
$23e^{82} - Er^{164}$	-96.5	4	54B4
$Br^{79} - C_6H_7$	-136.42	5	54C20
$2Br^{79} - Gd^{158}$	-86.6	2	54B4
Br^{79}/Br^{81}	0.975307	5	53H51
$Br^{81} - C_6H_8$	-154.05	5	54C20
$2Br^{81} - Dy^{162}$	-92.9	5	54B4
$Kr^{78} - 2C_3H_3$	-126.80	8	54C20
$Kr^{82} - 2C_3H_5$	-164.84	8	54C20
$Kr^{83} - C_6H_{11}$	-172.07	5	54C20
$Kr^{84} - 2C_3H_6$	-182.44	5	54C20
$Kr^{86} - 2C_3H_7$	-198.81	6	54C20
$Rb^{85} - C_6H_{13}$	-189.75	6	54C20
$2Rb^{85} - Er^{170}$	-111.7	8	54B4
$Rb^{87} - C_6H_{11}O$	-171.73	17	54C20
$Sr^{84} - C_6H_{12}$	-180.70	15	54C20
$Sr^{86} - C_6H_{14}$	-200.25	10	54C20
$Sr^{87} - C_6H_{11}O$	-172.05	6	54C20
$Sr^{88} - C_4H_8O_2$	-146.46	11	54C20
$2Sr^{88} - Hf^{178}$	-128.7	6	54B4
$2Y^{89} - Hf^{178}$	-131.6	6	54B4
$2Zr^{90} - Hf^{180}$	-137.1	3	54B4
$2Zr^{91} - W^{182}$	-135.5	3	54B4
$2Mo^{95} - Os^{190}$	-146.0	4	54B4
$3Ba^{138} - 2Pb^{207}$	-233.8	8	54B4
$Ce^{140} - 2Ba^{70}$	+56.8	8	53H56
$Pr^{141} - 3Ti^{47}$	+50.9	3	53H56
$Nd^{144} - 3Ti^{48}$	+66.7	3	53H56

MASS DIFFERENCES AND RATIOS continued

	Value		Ref.
$Nd^{144} - 2Ba^{72}$	+66.3	2	53H56
$Nd^{146} - 2Ba^{73}$	+65.8	4	54B4
$Nd^{148} - 2Ba^{74}$	+74.8	2	54B4
$Nd^{148} - 23e^{74}$	+72.3	4	54B4
$Nd^{150} - 3Ti^{50}$	+85.2	5	53H56
$Nd^{150} - 2Ba^{75}$	+77.4	4	54B4
$Sm^{144} - 2Ba^{72}$	+66.9	8	54B4
$Sm^{148} - 2Ba^{74}$	+71.9	4	54B4
$Sm^{148} - 23e^{74}$	+70.0	5	54B4
$Sm^{150} - 2Ba^{75}$	+72.5	8	54B4
$Sm^{152} - 2Ba^{76}$	+76.2	2	53H56
$Sm^{152} - 23e^{76}$	+81.4	6	54B4
$Sm^{154} - 23e^{77}$	+81.8	3	54B4
$Gd^{154} - 23e^{77}$	+81.0	2	54B4
$Gd^{156} - 3Cr^{52}$	+100.4	4	53H56
$Gd^{156} - 23e^{78}$	+87.5	2	53H56
$Gd^{158} - 28r^{79}$	+86.8	2	54B4
$Gd^{160} - 23e^{80}$	+84.3	2	54B4
$Dy^{160} - 23e^{80}$	+91.0	8	54B4
$Dy^{162} - 28r^{81}$	+92.9	5	54B4
$Dy^{164} - 23e^{82}$	+96.2	8	54B4
$Ho^{165} - 3Mn^{55}$	+84.8	8	54B4
$Er^{164} - 23e^{82}$	+96.5	4	54B4
$Er^{168} - 3Fe^{56}$	+126.0	3	54B4
$Er^{170} - 2Rb^{85}$	+111.7	8	54B4
$Hf^{176} - 2Sr^{88}$	+128.7	6	54B4
$Hf^{178} - 2Y^{89}$	+131.6	6	54B4
$Hf^{180} - 2Zr^{90}$	+137.1	3	54B4
$W^{182} - 2Zr^{91}$	+135.5	3	54B4
$Os^{190} - 2Mo^{95}$	+146.0	4	54B4
$Pb^{207} - 3Ba^{69}$	+196.6	8	53H56
$2Pb^{207} - 3Ba^{138}$	+233.8	8	54B4

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